COLOURING, TINTING AND TONING PHOTOGRAPHS

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TINTING AND TONING
PHOTOGRAPHS

Charles W. Walley

Prelude

THAT, after a number of reprints, there should be a call
for yet another edition of this book is alone sufficient
evidence of an awakening desire for relief from the emotion-
ally impotent black and white of the conventional photo-
graphic print, yet much more evidence can be found in the
increasing number of pictorialists who are braving the
conventions and boldly embracing the artful aid of colour.

And surely this is logical, for it is not a drab, grey world we
live in, yet it is in these tones we have it presented to us on
the exhibition walls. Form, arrangement, texture and detail
tell but half the truth ; only when colour is added can the
full emotional response be aroused.

Of course, there are processes of ' colour photography ' by
which, with costly material and great technical skill, a high
degree of realism can be achieved, but colouring a photograph
or lantern slide is within the range of everyone, and only
those who have chased a blob of colour over a print can
know its fascination. Of course, the tyro's first results will
be as crude as were his earlier attempts at making a negative
or print, but each new essay will produce something better,
and when, surprisingly quickly, he acquires a little skill
there will come with it a sense of pleasurable satisfaction
which is denied to those whose artistic expression is circum-
scribed by the limitations of black-and-white photography.

<div align="right">C. W. W.</div>

Contents

Introduction

THIS book describes the numerous methods by which the photographer who desires something more than a black-and-white print may introduce colour into his photographs.

Colouring a print is not difficult and it is a very alluring pastime. Colour can be applied in a number of ways. These include *Colouring,* either by water-colours, oil-colours, pastel, or other media; *Tinting,* which is a dyeing or staining process; and the chemical processes of *Toning.*

Content at first with simple mass tinting the reader will soon be trying his hand with water-colour or one of the other methods. But to begin with, the novice will need guidance and direction, and it is to provide such that this book has been compiled. Detailed working instructions are given in all the ways of colouring prints which are within the capabilities of those unskilled in the technique of painting.

The reader can take his choice; he should select the method which he feels is the one he can best handle, and it is well that he should persevere with that method until he has mastered it. *Application* and not inspiration is needed at the start.

The many toning processes described in the second section of this book, though only a step in the direction of colour, are certainly a long step and frequently an important first step towards a full-colour print. The toning of prints is fascinating when one has become familiar with, and is able to apply, the chemical principles involved. Selective toning has also been dealt with, showing how the wedding of a little chemistry and a little art may produce some intriguing results.

Innumerable toning formulæ have been published from time to time, but they are scattered over many publications ; and in this volume many typical examples with distinct characteristics are brought together. The book will, therefore, be useful for reference. Processes of purely academic or laboratory interest have not been referred to, as the purpose has been to cater only for the practical photographer, whether professional or amateur.

Facts About Colour

PRIMARY COLOURS

If we take pigments of the three primary colours—red, yellow, and blue—and master the art of blending them we can produce an amazing range of new colours. We know that red and yellow together will give orange, and that it depends only on their proportions whether the hue be nearly red or almost yellow. If we mix red and yellow with blue we may have brown, but again it depends on the proportions we use whether the result be very nearly a red, a yellow, blue, or purple. The beginner is therefore recommended to experiment with these three primary colours from his water-colour paint box and discover for himself what a range of others can be produced with them.

In painting, other colours in addition to these primaries are obviously necessary, otherwise the wide range of fine pigments manufactured would be superfluous, but the reader who finds a reference to the effect of, say, a spot of Viridian Green added to Rose Madder will have a better understanding of the effect if he has first made intelligent experiments with the primary colours. The following facts, however, will be helpful to those who are new to colour mixing.

From these pigments of the three primary colours—*Scarlet, Chinese Blue,* and *Yellow*—almost any other colour, except pure violet and purple, may be produced by mixing. Try it on a clean, white plate or sheet of glass. By mixing all three colours in about equal amounts, a neutral grey will result. Adding more and more Yellow to Scarlet produces shades from orange to reddish yellow. By adding varying amounts of Yellow to Chinese Blue, a series of greens is produced. Mix Scarlet and Chinese Blue : a whole range of dark purples and violets results. Secondary colours are produced by mixing any two primaries.

To make a colour lighter, add Transparent Medium.

To make a colour darker, add its complementary or else neutral grey.

Browns are tertiary colours requiring all three primaries for their production, and are obtained by adding Yellow to Violet or by mixing Scarlet, Chinese Blue, and Yellow. Some mixtures from primaries will be dirty (low saturation), and much cleaner secondaries can be obtained by the use of four fundamental colours instead of three, e.g. Scarlet, Yellow, Chinese Blue, and Violet.

COMPLEMENTARIES

Complementary colours balance and vitalise each other. A group of two, three, four or any higher number is complementary if the colours in the group can be mixed to produce a neutral grey. Thus, violet and medium green are a complementary pair, producing neutral grey when mixed.

For each known colour there is only one hue that is its complementary. However, in sets of three or complementary triads, there is more latitude. Taking Chinese Blue as an example, there is only one particular hue of orange-scarlet that makes with it a complementary pair, but a number of complementary triads containing Chinese Blue can be suggested :

Chinese Blue, Scarlet, Yellow.
Chinese Blue, Violet, Yellow.
Chinese Blue, Warm Brown, Violet.
Chinese Blue, Flesh, Medium Green.
Chinese Blue, Flesh, Yellow.

The most pleasing contrasts are obtained with complementary colours, but they must be adjusted to balance the colour scheme.

COLOURS IN SHADOW

The colour of objects in shadow seems to present some difficulties to the beginner, and one sees many examples of tinted still-life groups completely spoiled when the elementary principles governing the application of colour have been ignored.

Take, for example, a yellow cube placed in average natural light. It is useless to attempt to convey the impression of solidity by applying stronger tints of the same pigment to the areas in shadow. The eye appeals for the use of the other primary colours, i.e. red and blue, and we find that a wash of purple (red and blue) of adequate strength will give the desired result. It may need toning down with a little grey, but the foundation of the colour must be purple.

If a similar object be red, then by the same rule, green (blue and yellow) is the colour which, when washed over red, will produce a pleasant shadow of a brown nature. This will be found a sound rule, but the *exact* nature of the colour will depend, among other things, upon the quality of the light.

For example, the shadows on a haystack in strong sunlight are more purple than those of the same subject in a poor grey light. And similarly, the rich density of leafy foliage would be far from truthfully recorded if it were not for the introduction into the deep green shadows of Burnt Sienna, Rose Madder, or some similar warm colour.

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It will be noticed that grey trunks of trees in sunlight are warm in tone compared with, say, the cold shadows of grey stonework. Colours are described as warm, cold, or neutral. Yellow, orange, and red are warm ; blue, blue-greys, and green-blue are cold colours. By mixing a warm and a cold colour a neutral tint is produced, and this may be made to tend towards warmth or coldness by the addition of the suitable colour, e.g. yellow and blue give a green, but this neutral tint may be made to tend towards warmth by the addition of yellow, or made really cold by rendering it almost blue. Greys, therefore, may be made to appear warm by the addition of yellow or red, and cool by the admixture of blue or green.

Experiment along these lines is indeed an interesting occupation, and one that will well repay the hours spent on it.

The reader, before going further, should be quite sure that he knows the distinction between the following groups :

Primary Colours	*Secondary Colours*
Red	Orange (Red and Yellow)
Yellow	Purple (Red and Blue)
Blue	Green (Blue and Yellow)
Warm Colours	*Cold Colours*
Yellow	Blue
Orange	Blue-greys
Red	Green-blue

WARM COLOURS

SECONDARY COLOURS

PRIMARY COLOURS

COLD COLOURS
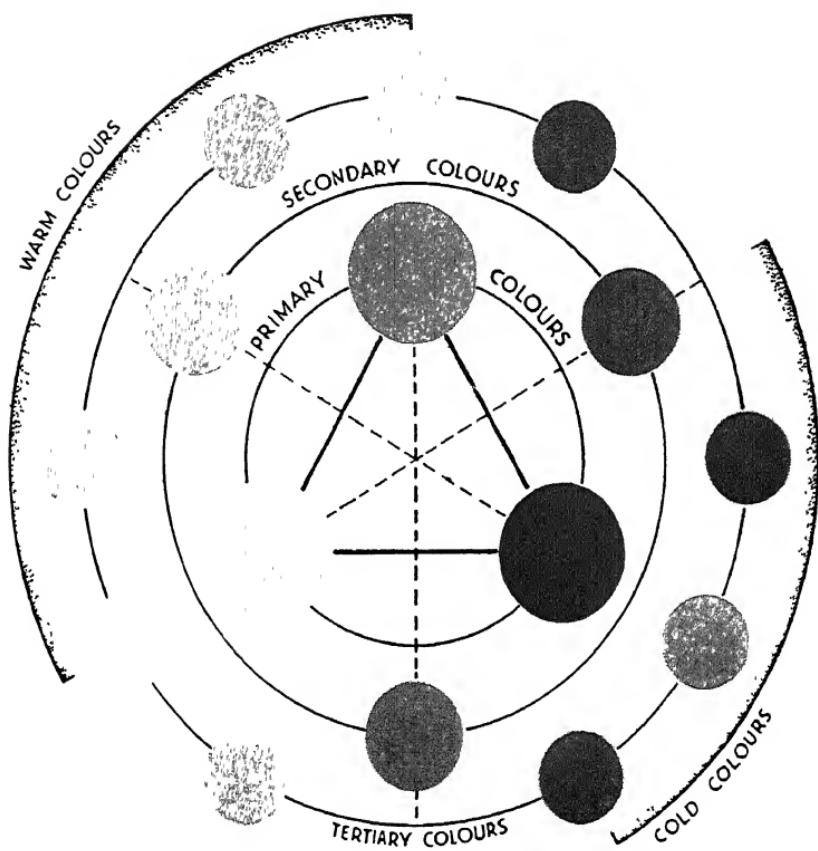
TERTIARY COLOURS

This Colour Chart will serve as a useful guide to the primary,
secondary and tertiary colours. The outer circle indicates
those colours which may be classed as cold or warm.

On Colouring Prints

It will be assumed that the reader is venturing upon the process of colouring for the first time ; in fact, that he has never before used a brush for tinting his photographs.

MATERIALS

An important consideration is the choice of materials. These must be of good quality, and, bearing in mind that they are cheap when compared with the cost of photographic material, one should purchase the best. Good resilient brushes are essential. Sizes 2, 4, 5, 6 and 10 will cover most classes of work, Nos. 4 and 6 being the most popular for general use. Palettes and a drawing-board will also be required.

THE IDEAL PRINT

Only matt prints should be coloured ; a tint applied to a sample of glossy paper is all the experimenting necessary to illustrate to the student that there is no comparison with the quality obtained by tinting a matt surface.

An Important Rule. Before colour is applied to a print it is a photograph : *when it is coloured it should still be a photo-*

graph—not a painting. In other words we must only tint, for if we approach the work as an artist approaches a water-colour, we are certain of failure.

The photograph has, or should have, all the modelling required, all the shadows and delicate tones from the darkest to the lightest grey ; if it hasn't, the application of colour should not be the means employed to overcome these deficiencies. There should be no need to introduce, as the artist does, any shadows and half-tones. Our tints are transparent and the tones which give modelling to the print will not be lost when the colour has been applied. The photograph which is devoid of half-tones and consists chiefly of harsh black and white will lose some of its violent effect on the eye if colour is intelligently applied, but it is a poor photograph and will remain poor when it is coloured. *A print is ideal which has an abundance of light, good quality and varied tones with reasonably strong shadows.* We shall find that, if well coloured, it will retain its pleasant lighting, and the varied half-tones will lend themselves admirably to the application of tints.

WHICH COLOURS ?

We have so far considered materials, choice of print, and the more elementary principles of colour, but even if we have assimilated all the advice given, we should still fall short of our goal unless we used our powers of observation. Let us take the simplest of examples.

When choosing a colour for a cloudless sky, it is natural for blue immediately to suggest itself, and if we glance overhead no doubt it will appear blue. But it does not follow that we tint the sky of our subject blue for this reason.

Let us view a landscape through a rectangle cut from the centre of a piece of card to correspond with the proportion of our print and, held at arm's length, we will find that the colour which recedes from the top edge of our picture right

back to the horizon is not blue at all, but probably of a delicate yellow nature ; or on a fine clear evening it may appear bright green gradating to the palest of yellow. That white cottage we can see tucked away amongst luxurious foliage, and bathed in the sun's rays, is not white but a delicate yellow, and if we are patient and wait for the sun to sink a little lower, we shall notice that it now appears a warm pink, and similarly everything else in the picture will undergo a change of colour, introducing an atmosphere we all associate with sunset.

Reference has already been made to the wise selection of prints possessing good lighting, tones and shadows, and we should be just as careful to look for pleasant colour harmony in our subject if we intend to colour the finished print. Should we take a photograph with this object in view, it will be helpful to make a few colour notes at the time of exposure. Experience will prove that only observation and study will enable us to extract full value from our colour-box.

CHAPTER III

Water-colour

THE handling of water-colours presents more difficulties to the beginner than any other medium. We are indebted to Mr. James Nicholls, one of the most successful exponents of the art, for the following very constructive remarks :

" Water-colour is the most suitable medium with which to approach most subjects, and although I am quite aware that some may disagree, I am equally sure that the majority will be in complete accord. Let us gather our materials and make ready to begin.

Materials. In the first place the student should purchase a nest of china pans in which to mix his colour, three red sable brushes Nos. 4, 6 and 10, a soft sponge, and a sheet or two of white, non-fluffy blotting-paper. Colour—small tubes will be large enough—should be ' Artists' Quality ' but also should be by a reputable maker.

Regarding the actual selection of pigments, the following are recommended : Cadmium Yellow, Indian Yellow, Yellow Ochre, Raw Sienna, Burnt Umber, Cobalt Blue, Ultramarine Blue, Prussian Blue, Crimson Alizarin, Light Red, Raw Umber, and Viridian Green.

As the student gains experience, the urge to increase this list and experiment with other pigments will be felt and should be encouraged,* but I feel confident that he will not discard for long any of the twelve which have been suggested.

Preparing the Print. The print should be immersed in water (which has been warmed a little) until it is limp, removed, and held under a fast-running cold-water tap for a few minutes. It should then be placed on a sheet of clean glass and gently sponged with water. The practice of colouring whilst the damp print is on the glass is quite successful, and may well be adopted if time is short. It is better, however, to mount all work except when tinting with oil-colour. The drawing-board upon which the work is to be carried out is best raised to an angle of not less than 30°. A plentiful supply of clean water is essential, and it is hardly an exaggeration to say that the water pot cannot be too large.

Clean water should be led over the work from top to bottom after it has been mounted, and it should then be allowed to dry out before laying the wash.

Laying the Wash. Plenty of water should be used when the tint is being prepared. Artists' water-colours are strong and, consequently, economical to use. It is necessary to add but very little pigment to the water to produce quite a strong tint.

As large a brush as can be comfortably used for the area should be selected, as one that is too small will inevitably produce an unprofessional finish. The point of the brush should not be used when laying a wash, but rather contact should be made at such an angle as to produce a wide band of colour as the brush is drawn horizontally across the paper.

* Chapter V gives some important information on the types of pigments which are suitable for mixing.—Ed.
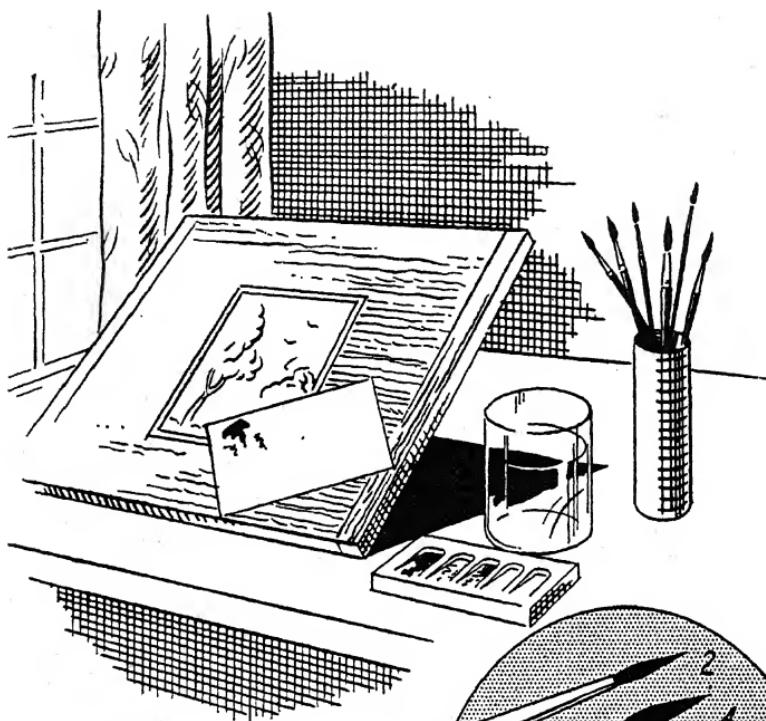
Work bench showing
drawing board raised
to 30° approx.
Note method of storing
brushes.
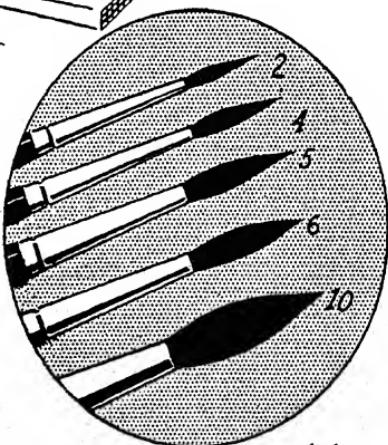
Sizes of brushes
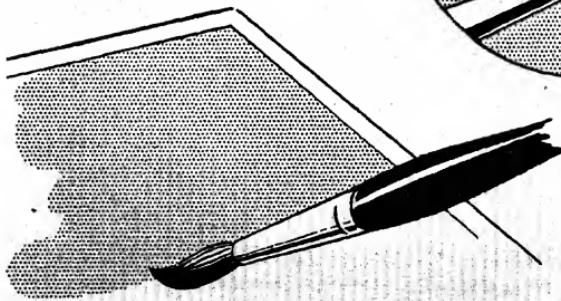
How to lay a wash.

The brush should be well charged with colour, almost to dripping point, and applied confidently across the top of the area to be covered with an even sweep from left to right. The angle of the board will cause the colour to collect along the bottom edge and this will be gathered up with the next sweep that is made. In this manner the tint will be led evenly over the paper. Colour should be applied from left to right and never in the reverse direction—assuming, of course, that the student is right-handed. When the wash is completed, the brush may be shaken out, and the darker ridge of colour which collects at the bottom of the wash removed by gently running the brush along it.

A little practice only is needed to tell the student when to recharge his brush, but it is a good fault to err on the wet side to begin with.

The student has been warned of the likelihood of failure if he attempts the work as an artist approaches a water-colour, but it is obvious that a successfully tinted print must possess some of the qualities of satisfactory water-colour painting.

The job of the water-colour artist is, among other things, to render a correct pitch of the tones, as well as accurate drawing. Our print, however, already possesses these qualities and our task is to apply colour in such a way that they will not be destroyed. The tone of the whole may be lowered, but at the same time compensated by the luminous effect of the medium. The student will therefore appreciate that a photograph having an abundance of light will enhance the ' vibrating ' effect of colour.

Order of Colours. **There is no such thing as a formula for laying colours ; a given order which will ensure a successful water-colour painting but spontaneous colour and freedom of execution would be lacking as a result of such a practice. On the other hand, until the student has progressed a little**

way towards developing his own technique, we can, together, colour our imaginary print and the student will be free to note the order in which the tints are applied.

The student must endeavour to think of his work as a whole and refuse to feel that he is merely ' filling-in ' certain areas with colour.

An Example. The illustration facing this page is a sketch of our test print. Rough colour notes made at the time of exposure read something like this :

Atmosphere—warm.

Light—right hand.

Colours—Sky : blue, pale and hazy.

Cloud : pale warm yellow, pinkish in half-tones, inclined to purple in distance.

Foliage : brightest in foreground and by bridge, tree on right deep and blue.

House : roof red-brown, walls white-washed.

Boat : bright blue-green.

General Impression—hazy heat and sunshine.

These notes are quite sufficient to recapture the setting.

Sky. Assuming the print to be about 9 in. by 6 in. we shall treat the sky chiefly with our No. 6 brush. A small quantity of Cobalt, Cadmium, Light Red, Ultramarine, Crimson, and Burnt Umber may be squeezed out into a couple of pans, keeping the pigments well apart.

A cobalt blue wash, prepared with plenty of water, should be applied—remembering the hints given on laying a tint. When the outline of the cloud has been reached, the brush may be shaken out and the tint that collects at the lower edge lightly gathered.

Clouds. To put in the cloud we may prepare three washes of Cadmium. Into the first the slightest trace of Light Red should be added to remove the rawness of the colour ; into the second, slightly more Light Red and a little stronger in tone—for the half-tones ; and into the third,
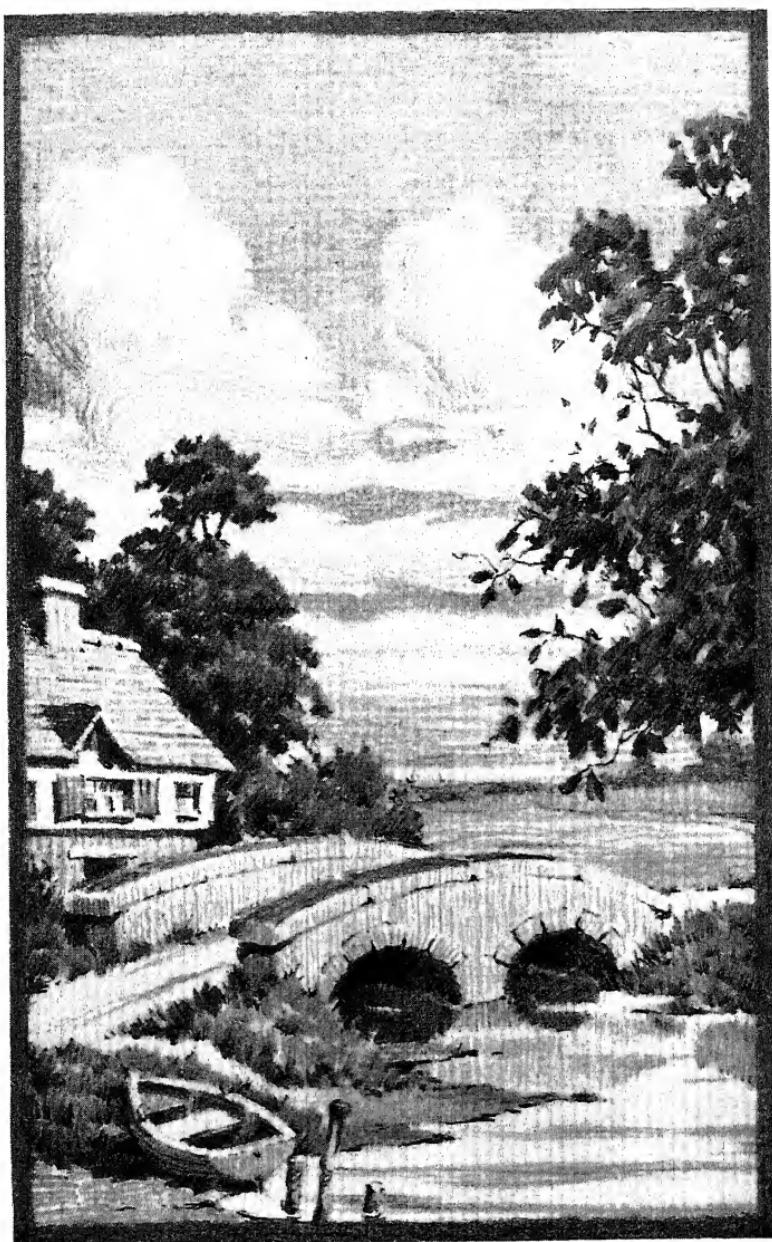
A sketch of the test print, the colouring of which
is described in Chapter III, "Water-colour"

Raw Sienna, a touch of Crimson, and a little Ultramarine to give a purple tinge to the cloud shadow.

Perfectly clean water is run rapidly round the top edge of the cloud shapes to prevent a hard edge, and the lightest tint run in. As we reach the half-tones the brush is shaken out, charged with the half-tone tint, and washed on. The colour will blend without an edge, and this treatment is repeated when the cloud shadows are reached. We may gather the tint again which collects at the lower edge in the manner previously mentioned.

Flat even washes are best kept thoroughly wet, but when we wish to introduce delicate shapes of blended colours and preserve the drawing, we shall find it easier if the washes are applied with a brush not too heavily charged, the colour being less likely to run where it is not wanted.

Distant Sky. The colour of the distant blue sky beneath the cloud is not so clear as our first wash, and this tint is best applied with the addition of a little Light Red to our Cobalt to tone it down a trifle and add a little warmth. The far distant cloud we put in with a wash prepared with Cadmium to which we have mixed a touch of Crimson and Ultramarine. The yellow nature will be preserved until the last hazy strip which meets the horizon. Here the colour may be almost purple, that is, with Crimson and Ultramarine predominant in our mixing, but rendered a trifle grey with a touch of Cadmium.

The treatment of the sky must be such as will preserve airiness, and we must be careful to keep our washes quite weak—especially the yellow of the clouds—until we reach the distant purplish tint. Whether we are satisfied with the effect or not, we shall be wise to continue with the stretch of marshy land that reaches from the far distance to the road behind the bridge. Our judgment will be far more accurate when all the print has received colour, and we shall leave our criticism until then.

Foliage. We have so far been using only our No. 6 brush, but the remainder of our print, with the exception of the foliage in the foreground on the right, can be more conveniently treated with a No. 4.

A little Viridian Green mixed with our last purplish tint will provide the best colour to begin our wash, which must be led over the far-off foliage. As the wash is progressing towards the middle distance, we may add a trifle more Green until, just before the road is reached, the mixing of more Viridian and Cadmium produces a definite green.

Before we lay on any more colour, we shall lead some clean water over the untinted portion of our print with a large brush and whilst this is drying off a little mix our next tint—for the trees on the left of the bridge.

A wash is prepared with Indian Yellow and Viridian of moderate strength, another with the addition of some Ultramarine, and a third mixed with a little Burnt Umber, Crimson, and a touch of Ultramarine. We must lay on the light yellowish green over the weaker tone of the foliage. The brush is shaken out and the deeper bluish green blended into the shadows. In the dense passages and the small branches, we shall introduce a touch or two of our third warm tint.

House. Next, the house roof may be put in, using Light Red with the slightest touch of Indian Yellow. For the shadows we use a little Burnt Umber, Crimson, and Ultramarine. The white wall of the house, bathed in the sunshine, appears tinged with pale Yellow, and a weak wash of Cadmium gives us the effect we desire.

Foreground Foliage. The foliage in the foreground on the right of our work, we shall treat in the same manner as that on the left, using a No. 6 brush. Our tint will, however, be mixed with Prussian Blue and Indian Yellow, to give a colder green, since it is out of the sun. Touches of

a purple nature run into the deeper tones will add quality and a rich density.

Bridge and Road. Our wash for the old bridge calls for the use of Cadmium, to which a touch of Burnt Umber and a little Light Red have also been added. We may run this tint over not only the bridge but also the road on the left and to the right as well. When this has dried out, we lower the tone of the road by running over it a faint wash of Burnt Umber to which a little Indian Yellow has been added.

The shadows under the arches of the bridge call for fairly strong purple, which we prepare with Ultramarine and a little Crimson. Reflections are a trifle bluer and should be rendered a little grey with a mere touch of Viridian.

Banks. The grassy banks provide our brightest green, and a wash of Viridian mixed with Indian Yellow, relieved with touches of pure Cadmium run in to the light spots, will look sunny and fresh. If we tone the remainder of this tint down with a little Cobalt and a spot of Light Red, we may use it for the reflection of grass in the water.

Water. The water will take the reflection of the sky, and may be tinted the same hue but slightly lower in tone. The brown earth at the water's edge and in the immediate foreground on our left, suggests the use of Burnt Umber and Light Red with touches of Raw Sienna run in the lighter tones.

Boat. For the boat, Viridian and Prussian Blue should be used on the outside and back. A little purplish tint is used just before it meets the grass at its side, leaving the surrounding top edge and seats white—toned with Cadmium.

Final Touches. With the exception of detail such as window-sashes and shutters, which are left to the imagination of the student, our photograph is finished. It may well be that we shall be satisfied to leave it untouched, but more likely we shall feel the need to run over certain passages again. We may, for instance, lay a glaze of either Indian Yellow or Cadmium over foliage or grass banks which have turned out a little dull, or tone them down if they appear too bright.

Here and there our work may show signs of being a trifle ragged. This will make the use of stipple essential, but it should be used sparingly. It is possible to ' lift ' colour which is too deep and strong by leading clean water over it and using the blotter. The tint may be layed-in again when this has dried out a little. Care should be taken that no fluff from the blotting-paper has adhered to the surface. But, if the result is to appear fresh and direct, this practice calls for skill which is the fruit of experience, and it is preferable for the tint to be weak in the first place, and strengthened if necessary by an additional wash."

STIPPLING

Stipple well executed, and in its proper place, can give a velvety quality that is unique. It is most frequently used in the tinting of portraits. It should never be used where quality and finish can be achieved without recourse to it.

How to Stipple. A brush of suitable size should be dipped in perfectly clean water and shaken out. The darker irregularities should then be touched and, while still damp, blotted with perfectly clean blotting-paper. This will take off some of the colour.

If these areas now appear too light in tone they should be carefully stippled in with a brush moistened with tint of the same strength and hue. If, on the other hand, the offending parts be already light in tone, then, of course, the operation should be carried out without first dampening with water.
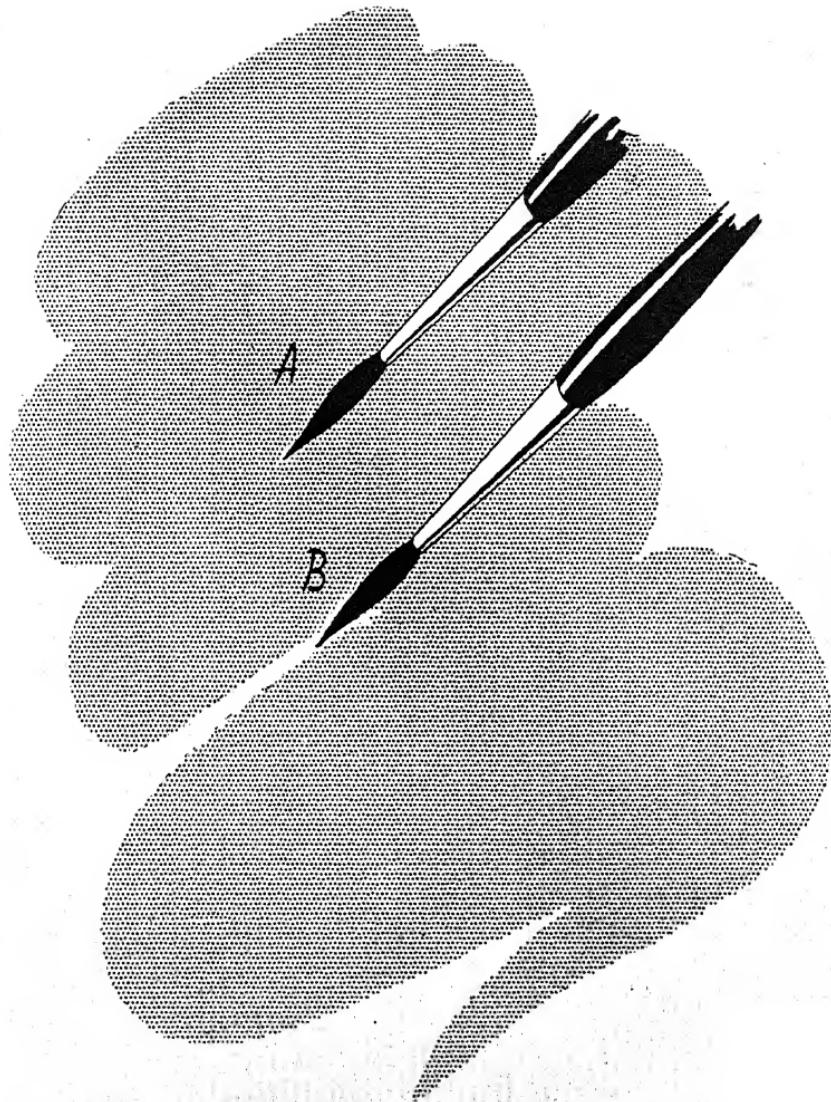
Stippling – A – darkening light
                    spots
            B – stippling in where
                wash has not covered.

To avoid a scratchy result, the point of the brush with which the stippling is done should not be too fine.

Some pigments are more difficult to erase than others, but if the operation is performed with reasonable care the student will find his labour rewarded.

Stippling, it will be seen, is scarcely a process in itself, but may often be a very useful aid in any of the conventional methods of colouring a print.

Water-colour Stamps. Readers who have only occasional prints to colour will find the " Velox " kit of Water-colour Stamps a great convenience. These consist of paper coated with dye, the dye being held by a gummy binder. The paper is perforated so that small sections can be torn off as required. One of these stamps placed in a little water will quickly colour it and so provide an excellent medium for tinting a print. If preferred, the stamp can be treated like a cake of pigment from the conventional paint box and the colour picked up with a wet brush. In the kit there is a book containing twelve sheets each carrying twenty-five of these detachable stamps—sufficient to colour a season's prints. Brushes are included and the lid of the enamelled box in which the whole outfit is packed is designed to serve as a mixing palette. All one needs, apart from the kit, is a few sheets of blotting-paper and some cotton-wool.

The colour solutions are prepared simply by separating from their respective leaves, one each of the following Colour Stamps : Light Yellow, Deep Yellow, Warm Brown, Brilliant Red, and Foliage Green. These are placed in separate dishes with a teaspoonful of clean water. The colour will dissolve instantly from its paper support and is then ready for use. If too strong for the particular work in hand, dilute by adding more water.

The method of using the colours is, of course, much the same as described earlier in the chapter. The manufacturers do, however, stress the importance of using very dilute colours.

CHAPTER IV
Oil-colour

ALTHOUGH water-colour has a charm that is difficult to resist and the colourist may be reluctant to leave it, yet there are certain subjects that seem to call for different treatment.

Charming old ruins that fill most of the picture, cool cathedral interiors relieved by the slanting rays of warm sunshine through leaded lights : these and similar " heavy " subjects may be treated advantageously with the *Transparent Oil* process. This medium may also be used for other kinds of subjects, but it is better reserved for those that seem to demand the rich nature of oil-colour. In preparing the following notes the writer has had the assistance of Messrs. Winsor & Newton Ltd., whose experience in the preparation of this medium is probably unique.

The reader will have noticed that the process is termed " Transparent," and obviously transparent colour only may be used if the image is to be preserved. Permanent colours of equal transparency, yet covering as wide a range as possible, must be chosen. This places certain restrictions on the selection of colours, but the student will by now have learnt what can be done with the three primaries alone.

The photograph should preferably be toned on cream-base paper with a rough surface. The surface is most important

because it is the pigment left in the grain of the paper rather than on its surface which gives the effect. The beginner should not attempt a print smaller than, say, 12 in. by 9 in.

MATERIALS

A tube each of Raw Sienna, Rose Madder, Cobalt Blue, and Viridian Green, a bottle of Spirits of Turpentine, a quantity of cotton-wool and possibly one or two No. 3 hoghair brushes, and the equipment will be complete.

Cotton-wool is employed to apply the colour, and a number of pads should be prepared in the following manner. Cut a strip of cotton-wool a couple of inches long, twist it, fold in half, and hold the ends between the fingers. One twist will produce a softish pad, several twists will, of course, produce a hard one, and both have their uses. Pads are usually held between the fingers, but a sprung-steel holder of the type used for crayons or short pencil ends will be found very useful. This handy tool, which can be purchased quite cheaply, has two sprung prongs and a sliding ring, and is mounted in a wooden handle. The ring should be pushed forward until the prongs grip the inserted pad quite firmly. Fresh pads should be used frequently during the work, and may be fitted in a few seconds.

PREPARING THE PRINT

The student should first take a good look at the work to be treated and be quite certain of the colour effect he desires.

With a soft pad that has been dipped in Spirits of Turpentine and squeezed practically dry, the surface of the print should be wiped completely over. The work should then be thoroughly gone over with a clean pad, using an even circular action.

APPLYING THE COLOUR

It is easier, as a rule, to commence with the lighter tones. The strength of the chosen pigments may be varied within reasonable limits by the admixture of Spirits of Turpentine.
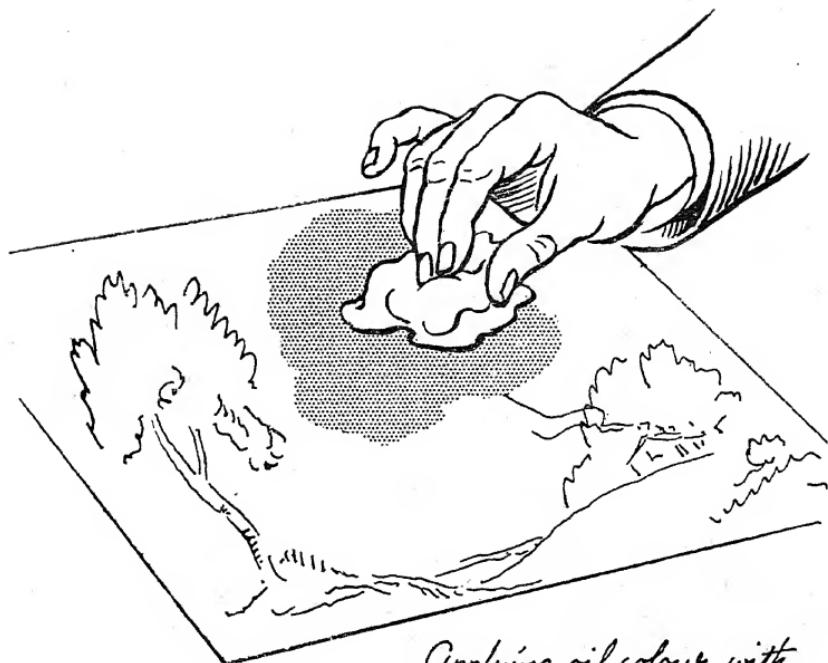
Applying oil colour with a soft pad of cotton wool after which it is gently wiped off.
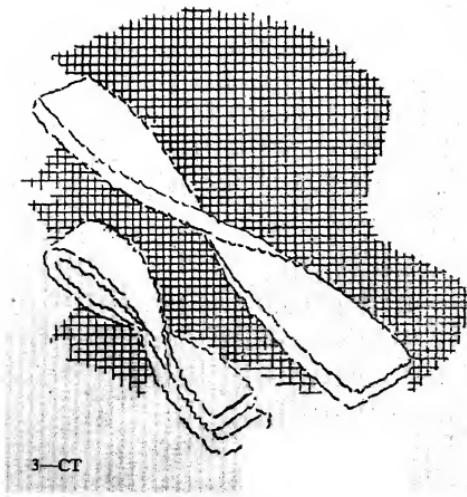
Pad of cotton wool for applying colour. 2 twists make a hard pad.

The colour is first laid on fairly freely with a soft pad, and then wiped off gently with a harder pad, again using an even circular action.

This may seem strange, but it is the pigment that is left in the grain of the paper which gives effect and the quality of fine stipple. If the colour is too deep, wipe a little more vigorously with a harder pad, still using a circular action. Should the tone, however, be weak, then more colour may be applied over the surface and the wiping process repeated.

Colour should be mixed off the print, but a tint that has already been applied may be varied by taking a little of the necessary colour with a hoghair brush, with which the surface of the print should be sparingly touched here and there, blending the colour, and then wiping with a fairly hard pad.

Any unwanted colour may be easily removed with the aid of a hard pad wrung out in Spirits of Turpentine.

Oil-colour takes a little time to dry and consequently the hand must not rest on the work. The student may be a little troubled by this, especially when attempting work of a delicate nature, but if a narrow strip of wood—which is wider than the work and supported by two suitably attached blocks—is used as a hand-rest, the difficulty is overcome.

Important. As will be seen later, some pigments should not be mixed with certain others as their ingredients have a chemical reaction in the course of time ; whilst others are too opaque. Nevertheless, there are occasions when touches of another colour may be necessary to give relief: Spectrum Yellow and Scarlet are safe to use. White may be used sparingly but should always be slightly toned down.

THE FINISHING TOUCH

Successful results should never be displayed behind glass, but be protected by a coat of Picture Copal Varnish laid over the work with a wide camelhair brush using even horizontal strokes.

Oil colour work has been greatly simplified by Messrs. Winsor & Newton and Messrs. Kodak Ltd., who both supply complete kits of the colours necessary as well as sizing, cleaning, thinning fluids and other materials required.

PORTRAITS

Here is the method of oil-colouring based on information supplied by Kodak Ltd :

Flesh. First, try a small spot to be sure the colour is of correct strength. For matt papers, Flesh colour should be mixed with some Transparent Medium. If the colour looks too red or coppery when you rub a little spot on the photograph—on some part of the skin that shows a highlight—then it is too strong and needs more Transparent Medium. Apply the Flesh colour over the entire skin area, covering eyes, teeth, rings, and necklace, completely, even carrying the colour up into the hair. Then wipe thoroughly with tufts of clean cotton. After applying the colour all over, remove it from the features, teeth, and other parts that do not require it, with Transparent Medium (as described in the following paragraphs).

Shadows. The application of special colours in the flesh shadows adds life and realism far beyond the effect supplied by photographic shadows alone. The colours in the shadows may be said to be warm or cool. Which colour predominates in any given case depends upon the complexion of the individual, the lighting and general colour scheme, and the character of the reflections. As a rule, if the subject is a brunette, the shadows will be warmer than in a blonde type. A warm shadow colour may be made by almost neutralising the purple character of Violet with Warm Brown.

It is worked into the flesh tint already applied and blended into the middle tones. Cool colours are especially useful above the eyelids, on the shadow side of the nose, under the

chin, on the neck, and on the back of the hand. To obtain a cool shadow colour, mix enough Medium Green with Warm Brown to produce a slightly olive brown. Warm shadow colour is generally used on the shadow side of the cheek, under the nose, in the ear shadows, under the eyes, inside the hands, and wherever there is a fold of skin (as at the bend of the arm). Reflected lights from cool colours occurring in the shadows, as foliage, and white, yellow and green clothing, can be tinted with cool shadow colour ; reflections from warm colours, as red and brown clothing or walls, can be tinted with warm shadow colour.

Eyes and Teeth. When the shadows have been tinted, the eyes and teeth can be coloured. The whites of the eyes always have some colour, generally bluish, but sometimes show tints of violet, green or yellow. Some of the highlights of the skin can now be accentuated by wiping with Transparent Medium to remove some of the flesh tint. Bluish, yellow, or greenish tints can be worked into the highlights, but these must be used very sparingly. Properly used, these highlight colours are capable of doing much to give a good likeness of the subject. The cheeks and the lips are tinted with Scarlet, reduced with Transparent Medium. This is modified slightly to match the colouring of the individual by the addition of a little Violet or Warm Brown. When tinting cheeks, have very little colour on the cotton ; most of it can be rubbed off on a piece of paper first. Then work it carefully into the flesh tint ; smooth up the cheek tint by rubbing with clean cotton. There are many details where a little local colour will add life to a portrait—such as the corners of eyes, eyebrows, nostrils, corners of mouth, and lobes of the ears.

Hair. The blonde type is generally found the most difficult to colour. Most beginners start with yellow. Yellow is the *last* colour to apply for blonde hair. The best base is mixed by adding Medium Green to Warm Brown until the reddish

hue disappears, but not quite enough to give it a suggestion of olive ; and this should be applied all over the hair without reduction, and rubbed down smooth. Next, reduce the colour in the lighter parts by wiping with Transparent Medium. Touches of green and brown can then be introduced into the shadows and reflected lights. For this green, mix Medium Green with Warm Brown to produce an olive green. For brown, use the blonde hair base described above, darkened with a little Violet. Finally, the highlights can be tinted with Yellow, reduced with Transparent Medium.

Remember that even golden hair has very little yellow in it.

The base for red hair is Warm Brown, and the shadows contain Violet and a dark green made by mixing Chinese Blue and Warm Brown.

The base of the dark brown type is Warm Brown darkened with just enough Chinese Blue to make a sepia, Violet, or both.

Black hair should be rendered by a dark mixture of Violet, Chinese Blue and Warm Brown, which should tend toward blue, violet or brown, according to the colour scheme. The highlights in jet-black hair are reflections of whatever colour is striking them. Grey hair : Unless such hair is all grey, a little Neutral Grey applied to all the hair and rubbed off in the highlights will give a good appearance. If the hair is all grey, no Neutral Grey is used. Colour the deeper shadows with dark blue or deep purple rubbed down.

Clothing. Usually the clothing should be coloured to accord with the actual colours worn, but a general law applies here. Colour the shadows of clothing with a deep shade of the same colour and the highlights with a pale shade of the clothing colour. To achieve this, let us suppose the dress is light blue. Rub on diluted blue over the whole dress. Make the colour even with dry cotton. With cotton on a stick, clean most of the blue off the highlights. Finally, trace over

the shadows with deeper blue to give roundness. In *white clothes* the shadows are bluish, or blue and violet. *Lace* is made transparent by clearing away all colour from the highlights of the lace and carrying the flesh colour into the lace.

Jewellery and Fingers. Gold ornaments are coloured with the same base colour as blonde hair and Yellow. Platinum and white gold are coloured in the shadow portions with much diluted Chinese Blue.

Pearl beads should have all colour removed with Transparent Medium, then the shadow part of each bead touched with reduced blue-violet.

Finger-nails should be touched slightly with diluted Scarlet, with a little Violet on the shadow side. Do not over-colour.

Backgrounds. Selection of the proper colour for a portrait background is governed by several factors: the key of the print; personality and tastes of the subject; colour of the skin, hair and eyes; colour of the costume; expression of the subject; subject's age; and the character of the design.

If the background is not plain, but contains a scene or interior set with curtains, etc., then colour it naturally, subduing the colouring and blending the colours so that the lines are softened. This tones down the background and tends to make the face or figure stand out. In portraits of children, pale clean colours are usually most effective on a high-key print.

When the costume has a dominating colour, the background must harmonise with or be complementary to such colour.

Differential rubbing-in of the colour will give a pleasing varied or two-toned effect, either mottled or in diagonal streaks, depending on how the excess colour is rubbed from the background.

Stippling consists of lightly touching diluted colour with a soft tuft and applying it lightly to the main colour of the background. Complementary colours should be used for stippling.

The colour of the hair will often influence the background colour. Suggestions for such harmonising colours will be apparent when one keeps in mind the colours which are usually worn by the various types :

Blonde : Blue, Black, light green, orchid, pale yellow, light brown.

Brunette : Orange, red, light blue, blue-violet.

Red : Blue-green, brown, light blue, deep-greenish blue.

The selection of background colours depends upon personal judgment. *Beginners should start with very subdued colouring,* gradually increasing the intensity and variety of the colours as experience and confidence are gained.

LANDSCAPES

The general rule for colouring landscapes is to colour the more remote portions first.

The Sky. To colour a large sky expanse in a landscape, apply Chinese Blue, diluted with a little Transparent Medium, with a " Soft tuft " and rub it in until the whole sky is just a shade too blue. Then, starting at the horizon with a " hard tuft," rub vigorously ; working towards the top of the picture, rub more and more gently. This will give a deep blue sky at the top of the scene which will get lighter and lighter as it reaches the horizon. The effect is to gain depth and perspective.

Clouds. Stratus clouds may then be worked in by the aid of cotton-wool on the pointed stick which is rubbed in a slanting direction along definite lines. Cumulus clouds are obtained with a touch of Transparent Medium on a " soft

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Blonde

Brunette

Red or Auburn

tuft." The base of most cumulus clouds is Neutral Grey blended in. If the first attempts are unsatisfactory, blend in again with blue and repeat.

A sunrise or sunset requires a faint pink blended in along the horizon. Then apply pale yellow in a deeper band and blend into the blue. This effect is especially attractive when mountains interpose to add depth and perspective.

Mountains. Far distant hills and mountains show tints of blue and purple, but mountains in the near distance or middle ground depend upon the nature of foliage, composition of the rock, direction of light, time of day, and amount of haze. Sunlight effects are heightened by using Yellow and Warm Brown with purple shadows and highlights of light-red rubbed down. Bare rock faces, where the sun strikes them, should be tinted with Yellow, Flesh, and orange made by adding Scarlet to Yellow. But all these brighter colours must first be subdued by dilution with Transparent Medium.

Foliage. For massed trees or forests in the distance (blue-green), use Medium Green with Chinese Blue added. Shadows are purple, and highlights call for Medium Green with more or less Chinese Blue reduced with Transparent Medium.

Trees in the foreground must be carefully coloured with attention to detail. Colour all leafy portions with Transparent Medium and dark green, made with equal quantities of Chinese Blue and Medium Green. Full-strength dark green may be used for deep shadows with Violet added in the deepest parts. The green can be changed towards olive by adding Warm Brown. Apply diluted Medium Green to the highlights and touch the higher lights with much-diluted Yellow or Scarlet. For autumn colouring use Warm Brown and Scarlet to get a terra-cotta red on massed foliage.

The shadow side of tree trunks are greys tinted with violet, purple, green, or brown ; the main trunk, warm brown or sepia ; leaf shadows, purple ; highlights where the

sun strikes the trunk are yellow, blue, orange, or flesh, but much diluted with Transparent Medium.

For grass or leaves in the foreground, use Medium Green, and work in Yellow in the highlights and deep green in shadows. For autumn tints, browns (mixed as described under the colouring of hair), orange and Scarlet are used. Sunlit spots are always yellower. Be sure to use enough Transparent Medium or the grass and foliage will look unnatural.

Water. Water reflects the colours behind or above it, and lakes and streams are usually coloured bluish green. Trees reflect in greens and browns. Brown and deep blue spots may be worked in. Water reflections are more subdued in colour·than the objects reflected. Spray or tops of waves are cleaned off with Transparent Medium. Wave crests are greenish ; troughs, blue to brown. Sunsets on water call for the use of Yellow, Flesh, Orange, and diluted Scarlet on both water and sky.

*   *   *   *

SEPIA-TONED PICTURES

Many colourists prefer a sepia-toned print for colouring, as the warmer brown image unifies the general effect and the whole colour-intensity key may be raised without the appearance of over-colouring. Any regular black-and-white print may be sepia-toned without difficulty by following the instructions included with each type of paper. Sepia-toned prints give the same effect upon colouring as though a primary layer of Warm Brown had been applied to a black-and-white print before colouring. If any one of the primary colours be applied, the effect is influenced by the sepia tone of the print. Yellow and Scarlet are of such hues that the colour change is not noticeable, but if blue is applied to a sepia print it will have a greenish tint. To neutralise this effect, a touch of Violet must be mixed with Chinese Blue for colouring eyes, or sky, etc.

<div align="center">

CHAPTER V

Suitable Pigments

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THE suitability of pigments for colouring prints depends on their transparency, their permanency, and their chemical reactions when mixed with other pigments.

TRANSPARENCY

Water-colours tend to be more opaque than oil-colours made from the same pigments. Therefore, only those which can be definitely classed as transparent should be chosen for colouring photographs. See classification on page 44.

This is not so important in the case of *oil-colours*, as most of them have a fairly high degree of transparency in use, covering the print in the form of a thin glaze without any admixture of white body colour. But to obtain the highest degree of transparency only those oils listed in the table as transparent should be selected. If a slight sacrifice of transparency is not objected to, colours not listed may be used·if suitable in other respects.

PERMANENCY

If it is known that the photograph when coloured will be kept in an album or portfolio, almost any transparent colours may be used, provided they are without action on each other

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(Prepared for this book by the Senior Chemist of
Messrs. Winsor & Newton Ltd.)

	Available in both Oil and Water-colour	*Available in Oil-colour only*	*Available in Water colour only*
Group Ia ABSOLUTELY PERMANENT	Burnt Sienna Cobalt Blue French Ultramarine Raw Sienna Viridian	Lamp Black Payne's Gray Trans. Gold Ochre	
Group Ib REASONABLY PERMANENT	Brown Madder Pink Madder Prussian Blue Rose Madder Spectrum Violet Spectrum Yellow Winsor Blue Winsor Green	Oriental Blue Scarlet Madder	New Gamboge New Hooker's Green, Dark Neutral Tint Payne's Gray
Group II MODERATELY DURABLE·	Alizarin Carmine Alizarin Crimson Alizarin Green Alizarin Scarlet Antwerp Blue Emerald Green Prussian Green Purple Lake Purple Madder Sap Green Spectrum Red	Alizarin Purple Caledonian Brown Rose Madder (Alizarin)	New Hooker's Green, Light
Group III FUGITIVE	Carmine Crimson Lake Mauve (Red Shade) Mauve (Blue Shade)	Carmine No. 2 Geranium Lake Magenta	

In the above classification synonyms have been avoided, the more
common name being used.

(see " Mixture of Colours " below). But if the user attaches importance to the permanence of the result, and especially if the photograph is to be framed and exposed to daylight, it is important to choose colours of as great a degree of permanence as are available.

For permanent results colours in Groups II and III should be excluded, but all the colours in Group I (*a* and *b*) may be used. If, in the case of oil-colouring, a choice should present itself between a transparent but impermanent colour, and a permanent colour not classified as transparent, there should be no hesitation in selecting the latter.

MIXTURE OF COLOURS

As already mentioned there are certain colours which act on each other chemically when mixed together, and the permanence of a mixture can no longer be deduced from that of its constituents. For instance, if we make two lists, one containing the Cadmium Sulphides and the other all the pigments with a base of copper, then no member of one of these lists can be mixed with any member of the other without risk of blackening.

(i) *Colours containing Cadmium Sulphides :* Cadmium Yellows ; Cadmium Orange ; Orient Yellow ; Aurora Yellow.

(ii) *Colours containing Copper :* Emerald Green ; Malachite Green ; Malachite Green No. 2 ; Verdigris.

The Vermilions (and, in water-colour, King's Yellow) being also, like the Cadmiums, metallic sulphides, should be included in List No. i, as also should Jaune Brillant, the Naples Yellows, and Neutral Orange, which contain Cadmium, and the old form of Scarlet Lake, which contains Vermilion. Some of these mixtures, however—such as that of Vermilion with a Copper Green—are unlikely combinations.

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The Vermilions and Cadmiums are also likely to blacken White Lead, as are the Chromes if they have been unskilfully prepared. Mixtures of the Cadmiums and Vermilions with Prussian Blue (or of pigments containing Prussian Blue) are also of doubtful stability.

Again, certain chromates (Chrome Yellows, Orange, and Red, Citron Yellow, Primrose Yellow, and Strontian Yellow) cannot always be safely mixed with Prussian Blue, or with pigments containing Prussian Blue. These chromates are, in fact, best kept apart from those organic pigments, which, like the majority of Lakes, are easily oxidised.

Mixtures of Aureolin or of the Alizarin Lakes, with the Ultramarines, or of any of the Lead Whites with the Ultramarines are better avoided. Zinc White should, in the latter case, be substituted.

Mixtures of Aureolin or of pigments such as Mars Yellow (rich in uncombined ferric hydrate) with organic pigments, should also be regarded with suspicion.

The permanence of a colour is not, as a rule, improved by mixing it with White (the Lead Whites or Zinc White in oil, and Chinese or Constant White in water), or, in fact, by mixing it with other permanent pigments. If the colour be a durable one, it will probably suffer no injury, but any weakness in resistance to light and air is frequently accentuated by the dilution which is a necessary consequence of such admixture.

The technical information in this chapter is provided by the Senior Chemist of Winsor & Newton Ltd., refers to Artists' colours made by them and will not necessarily apply to other products.

Pastel, Crayons, Opaque Water-Colours *(tempera)* and the Aerograph

PASTEL

PASTEL work can be very effective and a standard of proficiency reached rather sooner than a similar mastery with the brush. Two kinds of crayons are used for pastel work, the hard and soft non-greasy variety, and the pure colour of greasy consistency—the wax crayon. The latter has a serious disadvantage in that, having applied a chosen colour, it is not practicable to cover any part of the surface again with another hue ; the second application has a tendency to slip over the surface, leaving little or no effect behind. Handled by the expert wax crayons can provide good strength, but since this is not an essential quality they are best avoided. Good quality soft Pastels of non-greasy consistency can be confidently selected, and there is a really wide range from which to choose.

Selection of Print. It is essential that a rough surface be used and that the tones and shadow effect, although artistic, are not too strong. With this medium one must endeavour to *convey the impression of colour* rather than load the paper with Pastel.

Blending Pastels. A " tortillon " is used to blend the Pastel, and this resembles a thick, blunt-ended pencil. It is made from paper and rag pulp and can be purchased for a few pence at any establishment selling artists' materials. It is advisable to provide a few of these, keeping each tortillon to cover the use of colours of a similar hue.

Handling a Portrait. Let us assume that we have chosen for the subject a fair-sized portrait—one preferably printed on a cream-base paper and toned.

The direction of the strokes should follow the modelling. With touches of light red stroked over the lighter tones of the face take a tortillon and with a gentle circular action help the medium into the grain of the paper. A little Yellow Ochre laid on in the same manner will probably be found necessary. The shadow on the face will now appear cold. A few light strokes of Burnt Sienna, and a touch of Rose Madder again annealed into the grain, will relieve the impression and create a little warmth. Take the hair and assume it to be of a golden tint. Near the lights and in the direction of its growth, touch on a few crisp strokes of, say, Lemon Yellow, blended with a little Burnt Sienna in the half-tones, and a mere suggestion of Cobalt as this impression gradates into the stronger shadows. An artistic golden effect should result.

The cheeks, nostrils, lips, etc., may be stroked with Rose Madder, and near the light on the lips a crisp touch of Cadmium Orange Red is called for. The colour of the eyes can best be conveyed by the merest flick of suitable tint in the half-tones and left untouched. With similar treatment the whites of the eyes are put in, but should never be left pure. Take a tortillon with the slightest smear of warm grey on it and touch the whites to tone them a little. Whatever the background colour, it should be treated quietly.

Now study the effect. It may be found, for instance, that the Cobalt touches in the hair are violent and cold, giving a
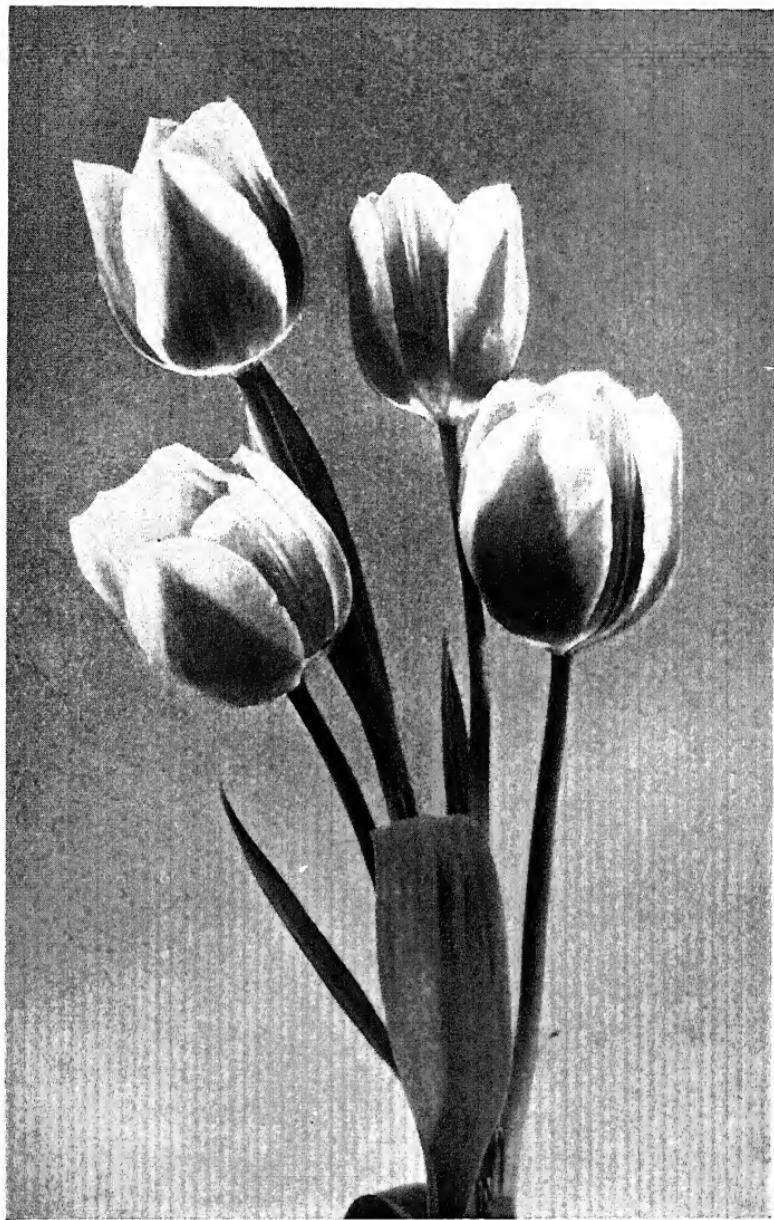
Broad masses and simple outlines provide most effective results when using the combined staining and colouring method described in Chapter VII, " Dye Tinting and Staining "

Colouring Portraits with Pastel — Strokes should follow the modelling as shown above.

metallic appearance. Remedy this with the addition of a few strokes of, perhaps, Burnt Sienna or even Sepia.

As a rule too much pastel is used by the beginner, but experience will teach him that the best effects are gained by using the crayons reticently. Free treatment must be practised—the whole hand should travel with the strokes.

Fixing Pastel Work. Pastel work will not stand up to any handling unless it be fixed with Pastel Fixative. This, and a blow-spray with which to apply the solution, may be purchased quite inexpensively.

SOLUBLE CRAYONS

The art of print colouring may be simplified by the use of Soluble Crayons, such as those marketed by Kodak. These need little skill in applying and a few experiments on some old prints will soon show the beginner how much can be done—and what must be left undone. As the colours are transparent, they do not cover up the " drawing " and portraits may, therefore, be successfully tinted by the inexperienced colourist without the usual danger of losing the likeness. For landscape pictures they are, of course, equally satisfactory.

The Ideal Print. Prints for colouring with this medium should have a fine grain or " art " surface—glossy prints are not suitable. For portrait subjects, sepia-toned prints are preferable as these will be found to give a warmer glow to the shadow colours of flesh than is given by a black-and-white print.

Preparation of Print. Take a small rolled pellet of cotton-wool and on this put one drop of Kodak medium. Rub this well over the surface of the print, which should not, however, be made too wet.

Applying the Crayon. Apply the colour to the print with a light " scribbling " motion, holding the pencil at such an angle that the surface of the print is not scored or damaged. Then, with a dry, loose pellet of wool, lightly rub over until the tint is spread and any lines made by the crayon subdued. For working very small areas a smaller pellet of wool should be used on the end of a pointed match or orange stick. The same principles for colouring apply here as in the case of oil and water-colour as already described.

Note.—A mixture of red, yellow and blue will make a black or neutral tint. Take care, therefore, to change the woollen pellet frequently, as wool charged with various colours will impair the freshness of the work.

OPAQUE WATER-COLOURS*

Including Gouache, Distemper, "Designers" Poster, Show-card, Tempera, and Waterproof Showcard Colours. These provide a total departure from the other media discussed in that the colour used is opaque. The print serves only as an outline on which a colour picture is superimposed. The pigment may be purchased ready-mixed in small bottles in any of the forms mentioned above, or the student can prepare a variety of gouache or poster colour for himself. Dry colour in powder form, with Zinc White if necessary to increase the opacity, a bottle of gum arabic, a medium-sized palette knife, and a few good-sized white glazed tiles upon which to grind the colour are all that is required.

Preparation of Medium. Select the colours to be blended, make a rough estimate of the proportions, add a little water and a spot of gum arabic, and with the palette knife grind them together until all signs of grittiness have disappeared and a smooth paste is the result. To avoid wastage, always commence with the lighter colours and add the stronger hues to them until the desired shade is obtained. Make a sample

* These are often referred to as Tempera, but this term is strictly applied only to water-colours containing oil or wax in emulsified form.

test on a slip of cartridge paper. When this has dried, with the finger-tip rub the surface fairly vigorously. Should it rub off, add more gum arabic and grind it into the mixture again. If the colour dries unevenly when carefully applied, too much gum has been used. Some pigments need more gum than others, but the student will soon master the art of mixing his colours by this method.

Application of Colour. In applying the colour always use a brush large enough for the area. Cover all the surface whilst the colour is wet and finish with even horizontal strokes. If the colour is left to dry too soon, a mottled effect will result, while working the colour too long will cause " drag " lines to appear.

Body colours, whether ready-mixed or ground from powder, dry out lighter than they appear when wet. The ready-mixed medium has a little more lustre, containing ingredients to produce this quality.

The need to study the tone values closely before any attempt is made to lay on colour cannot be over-stressed. The medium is opaque and unless the tones are kept faithfully in place, unity will be completely lost. The beginner is strongly recommended to lay in the lightest tones first, as they are the least likely to cause trouble. Half-tones next, following with the shadows, and finishing with the more delicate shades and " accent " touches. The worker will in time develop his own technique.

The photographic image will be quite hidden when the work is completed ; it is important, therefore, to preserve the " drawing " and tone unity of the original photograph when working with this process.

AEROGRAPH

Any of the media so far described can be employed by the Aerograph technique, with the exception of oil-colours.

Aerograph
- Slight depression of
knob gives fine spray.
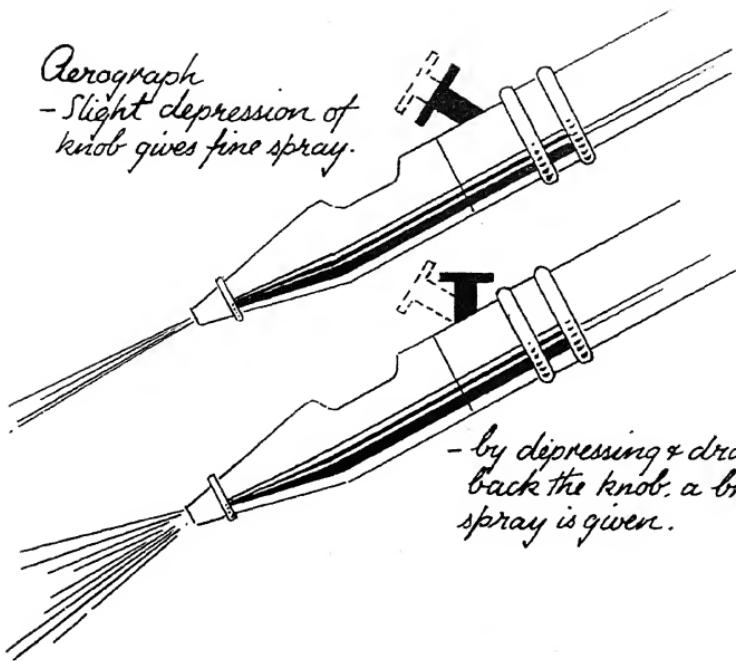
- by depressing & drawing
back the knob a broad
spray is given.
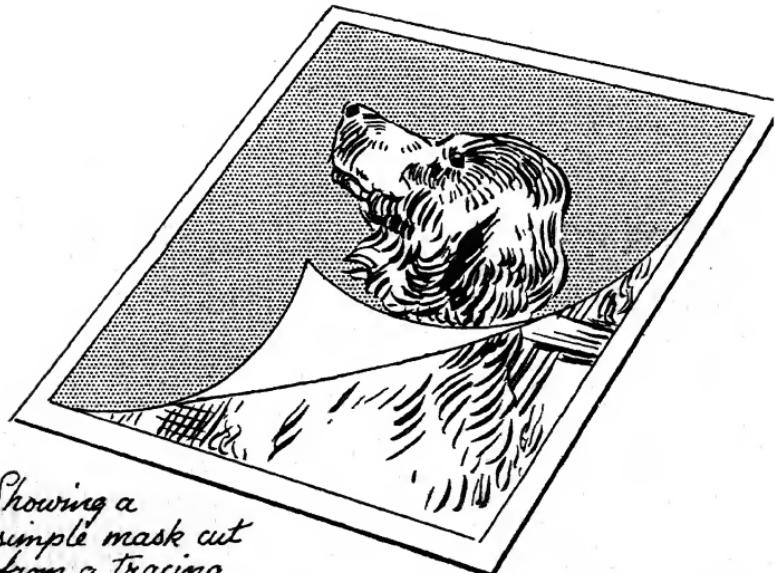
Showing a
simple mask cut
from a tracing.

Description of Aerograph. The popular model of this machine consists of a cylindrical tank fitted with a pressure gauge, and serving as a reservoir which is fed by a foot-operated pump. A flexible tube leads from the tank to the " air brush," which resembles a fountain-pen. This is charged with a brush loaded with the selected medium and released in an extremely fine spray by a finger-operated trigger. The quality of the spray is regulated by a nozzle at the end of the " brush." Should opaque colour be used to any extent, the instrument should occasionally have a solution of Borax and hot water sprayed through it to keep it perfectly clean. If this is neglected the instrument will splutter, with disastrous results. Experiment should be made with the pressure, which the beginner will doubtless find easier to manage if it is kept on the low side.

Use of Aerograph. A careful tracing of the work is made, and with its aid masks are cut from thin white card with a sharp-pointed knife. Following the general rules given in the section dealing with the Tempera method, mask the area around the portion to be treated, weight them with the aid of several coins, and apply an even spray. Do not allow the colour at any time to flood. When the colour is dry, repeat the spraying if it is necessary to build up strength. Assuming the masks have been cut with care, they may be fitted together " jig-saw " fashion to mask any desired portion, thus the whole print will finally have been treated. It is obvious that the chief feature of the Aerograph is its ability to produce photographic gradation of colour, and the expert worker can confine the spray to quite small areas without the use of masks, in this way avoiding hard lines of division between one colour and another.

Dye Tinting and Staining

DYE TINTS

I⊤ is possible to achieve subtle and varied colour schemes with dye tints, but it needs clever and speedy manipulation of the brush to produce the best results. The initial outlay is slightly less than when using water-colours. Dye tints do not have the same resistance to fading as well-chosen pigmentary oil or water-colours.

A Tinting Outfit. The colourist who wants to try his hand with the minimum of trouble can start off with one of the made-up tinting " sets " such as is marketed by Johnsons of Hendon, Ltd., or Winsor & Newton Ltd.

They are used in much the same manner as water-colours, except that they are already in liquid form. The student will find them very concentrated and he should always endeavour to work a little under strength.

To prepare the wash, fill the china pans with sufficient clean water to cover the area to receive the tint, and *then* add the selected colours to it. This helps the student to gauge more easily the strength of hue he desires.

Applying the Tint. The beginner will probably find it more difficult to lay an even wash of ink than a similar wash of water-colour. The bands of colour applied in the usual manner have a tendency to dry with a streaky appearance owing to the indelible nature of the medium. For this reason the print should be as damp as possible, but not, of course, so moist that the washes cannot be confined to a given shape or area. Although a speedy brush manipulation helps to overcome this difficulty, the student must at all costs give himself time in which to think about his selection of colour and the effect he desires to produce. It is a simple matter to lead a pool of clean water with a suitably large brush over the untinted area which has become dry, blot off the surplus, and thus leave the surface in an ideal condition once more.

Tinting inks are transparent and inclined to be brilliant, but they can be toned down by the use of other inks.

A few drops of a wetting agent such as Johnson's 326 added to either the tints or the water used to dilute them, will help to ensure more even washes and will overcome that " oily " effect sometimes encountered on glossy, or hardened, prints.

Correcting Faults. Offending irregularities may be stippled out, but since the colour is rather difficult to lighten with brush and blotting-paper, there is an advantage in tinting rather below strength and, if necessary, stippling lighter patches which may occur in the wash with a faint tint of the same nature. Slight over-tinting may be weakened by the simple process of soaking in clean water, careful use of a soft sponge, and a final rinse under a running tap.

These tints may be obtained in treble strength, but it is advisable for the beginner to keep to standard strengths.

STAINS

The needs of the humbler photo-colourist have been provided for by the series of Burroughs Wellcome " Soloid "

Stains, which are supplied in blue, green, red, and yellow. These stain the paper and the emulsion, leaving the black image unaffected. They may be employed on daylight papers as well as development papers and lantern slides. Modifications of colour may be obtained by varying the strength of the solutions used and by mixing the stains.

Prints to be stained should not be hardened and should be soaked in plain water until flaccid, surplus moisture being afterwards removed. If the whole print is to be coloured— for example, a firelit scene would be effective if stained red —the print is immersed in a solution made by dissolving one " Soloid " Stain product in four ounces of water. By decreasing the quantity of water used, stronger effects are obtained, while weaker solutions produce more delicate tints.

When it is desired to treat portions only of a print, the toning solutions or stains may be applied locally by means of a small tuft of absorbent cotton or by brush, or those areas which are not to be toned may be protected with a masking varnish (such as, for instance, the Rossite Resist mentioned elsewhere), and the print treated by immersion. As a precaution against penetration of the toning solution from behind, the back of the print should be varnished. After toning with one colour, the masking varnish may be removed by alcohol or turpentine or, in the case of Rossite Resist, merely rubbed off, and other parts masked as necessary to protect them whilst other toning solutions are applied.

COMBINED STAINING AND TONING

To commence, it is as well to select studies with broad masses and simple outlines. The study of tulips facing page 48 may be coloured in the following manner :

The blooms should be carefully bleached in a solution of the bleaching compound from the " Tabloid " Sepia Toner. This is applied with an artist's brush. After washing, the

Local Toning.
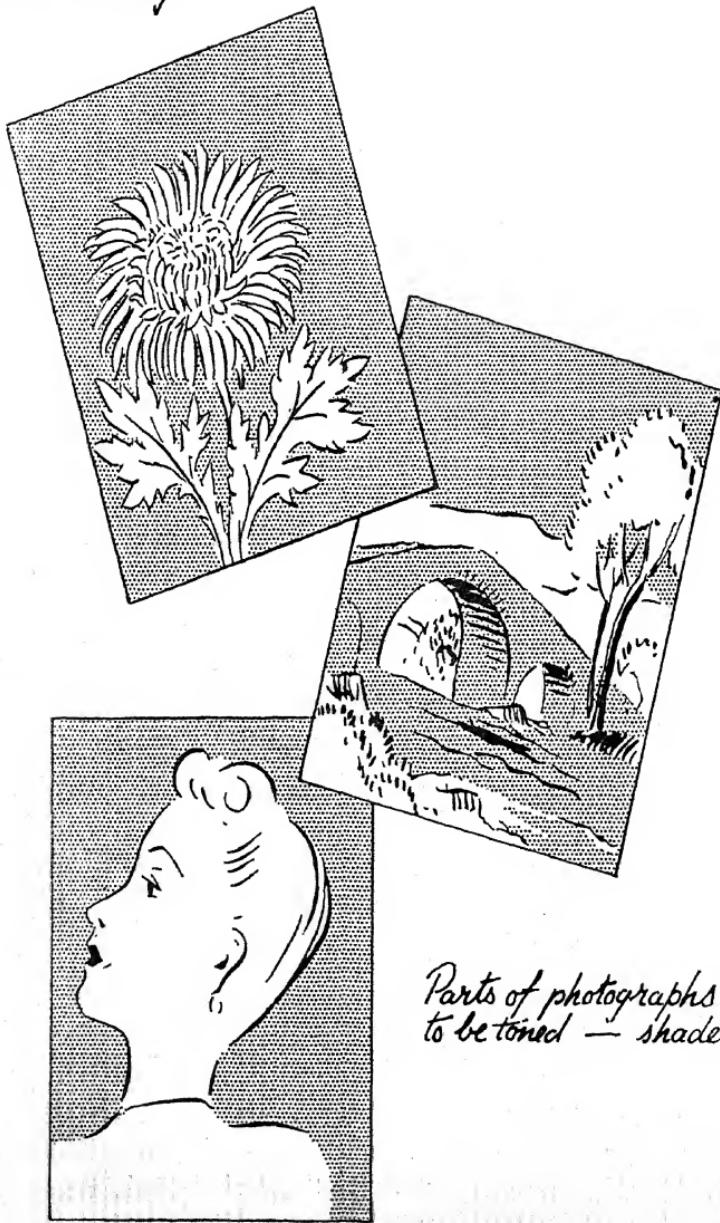
Parts of photographs not
to be toned — shaded.

print is treated in the sulphiding bath, again washed and dried, which leaves only the blooms sepia-toned. Although this step is not absolutely necessary it will be found that a sepia-toned image is not so insistent as a black-and-white one, and is, therefore, preferable when the image is to be subsequently coloured by means of stains.

The background of the dried print should then be painted over with protecting varnish, carefully following the outlines so that the foliage, blooms and stems are left unprotected. Copal picture varnish, obtainable from dealers in artists' materials, is a suitable masking medium. When the varnish has set (not dried) the print can be treated with " Tabloid " Green Toner as described in the maker's instructions. After washing and drying the print the protecting varnish may be removed by turpentine on cotton-wool. It should be noted that although the blooms are unprotected by varnish, the green toner has no action on the sepia-toned portions.

The next step is to protect the green-toned areas by means of varnish and subject the print to the process of blue toning, by which the background takes on a graduated blue colour. The print is again washed and dried and the varnish removed.

Finally, the blooms should be treated with yellow and red stains applied on an artist's brush, the yellow wash first, given all over the blooms, and then the red stain should be applied to the dark portions of the flowers.

WATER-COLOUR STAMPS

These have been dealt with in Chapter III, " Water-colour." They may, however, be used in exactly the same way as Photo Tints.

COLOURING LANTERN SLIDES

Transparent water or oil colours *can* be employed for colouring slides but the range of colours is greater and their application easier if dye tints are used. The instructions given in the earlier paragraphs of this chapter apply to slides as well as to paper prints.

If they are to be coloured, the slides should be made on either the Kodak " Black Tone " or Ilford " Special " lantern plates as a pure black image is most suitable for colouring ; the warmer type of image makes such colours as blues and greens more difficult to deal with. M.Q. or Azol are the best developers and slides should be fixed in an acid fixer but need not be subsequently hardened.

It is not necessary to wet or soak the slides before applying the tints except when a large area has to be tinted with an even colour such as a blue sky in a landscape, when it is an advantage to wet the surface and apply the tint with a fairly large sable brush or swab of cotton-wool.

The paler shades are best filled in first and the deeper colours and finer detail left to the last. The Photo Tints now supplied in triple strength are particularly useful when a deep rich colour is desired.

It is important that the colouring should be done on a re-touching desk entirely by artificial light as this source of light is used in the projection lantern.

The pictures reproduced on the jacket and frontispiece are from lantern slides coloured with Johnson's Photo Tints which are obtainable in sixteen colours.

The Colourtone Process

PHOTOGRAPHERS have always wanted something which would protect portions of a print from reducers, intensifiers, or dyes whilst working on other portions of the print. The answer is a rubberoid solution—known as Rossite Resist—which is incorporated in the Rossite Colourtone Kit. It is lightproof, impervious to the action of any chemical used in photography, may be applied with a brush, dries rapidly, and can be completely removed by simply rubbing it with the finger.

This resist makes selective toning a comparatively simple matter, and multi-chemical development—where one starts with the normal bromide print—is just as easy. It can be employed in all processes where colour is obtained by development, toning, or staining.

ROSSITE COLOURTONES

Preparation of Solutions. The tints are known as Rossite Colourtones and stock solutions are made as follows : A colourtone is mixed into a thick paste with hot water, and then more hot water is added to make up to 8 fluid ounces. The solution is then filtered to get rid of any undissolved colour. So prepared, the stock solution will last indefinitely.

Colourtones can all be intermixed to produce innumerable colours and shades.

The Process—An Example. The process of colouring the print can be explained by a simple illustration. One has, say, a photograph of a Union Jack, flying from a white flagstaff against a blue sky. There should be three colours on a bromide print of this—Red, White and Blue—and solutions of the Red and Blue colourtones are first prepared. The print is then covered with the resist, except for those portions which are to be, say, blue. The resist as supplied is of the correct viscosity. As its virtue is quick drying it naturally evaporates quickly, but, if necessary, it can be thinned down by adding the solvent which is supplied with the kit. The resist is easily controllable and using a large-sized brush (size 5 or larger) the work may be quickly and accurately done.

Next take half an ounce of the stock blue solution and dilute with twenty parts or more of water. Add half an ounce of Assetac supplied with the kit ; this is essential, as it activates the colour and makes for permanency. If the colour looks too blue, dilute still further.

Now place the Union Jack print in the solution, having first immersed it in water. This preliminary soaking is advisable to ensure an even flow of colour ; otherwise, as in normal developing, one is liable to get air bubbles. The longer the print is in the Colourtone, the darker it will get ; therefore it is advisable to use dilute solutions and allow the colour to build up as required. When the required depth of colour has been obtained, remove the print and immerse immediately in running water, washing thoroughly for a few minutes. Rough dry between blotting-paper or a towel and remove the resist by gently rubbing. Again immerse the print in water to ensure even shrinkage—the resist in preventing the water affecting parts of the print, causes it to buckle. Quick dry on a towel again and paint with the resist those parts which you do not want to be red. Now apply the

red colour in the same way and, when finished, you have a Union Jack, red, white, and blue, against the blue sky.

Portraits. In the case of portraits care should be taken to " resist " eyes and teeth when applying the flesh colour. The flesh colour can be varied as required. It must be remembered that there is always present a grey or blue tone wherever there is a deposit of silver, and this materially affects the colour applied. The silver salt is not changed in colour by the Colourtone, therefore, at times the flesh tint gives too dark a colour. This can easily be altered after a little experimenting by the addition of either Yellow, Red or Blue until the required flesh tint is obtained.

A portrait is dealt with in the following order :

Background. Resist the figure and immerse in a solution of the required colour for the background.

Flesh. Cover the background and the dress and immerse in the flesh Colourtone, having protected the eyes.

Clothes. Cover the face and neck and immerse in the colour for the clothes.

Note that when applying a light flesh tone, the whole print can be immersed in this, apart from the portions which are to remain the basic colour of the paper (eyes, teeth and white patterns). Then protect the flesh portions. If in this case the background had to be a deep blue or green and the clothes a strong dark colour, the flesh colourtone could have been applied to the whole print, apart from the eyes. The dark blue background would have been unaffected by the light flesh. So, too, the garments ; by a careful choice of colours much work can be saved in this way.

Smaller Details. The eyes and lips have still to be dealt with. Paint round the eyeballs and lips carefully with the resist, making, as it were, a small pool, then drop in dilute solutions of, say, blue for the eyes, and red for the lips, absorbing the liquid with cotton-wool when the right density of colour has been reached.

This same " pool " method can be used for jewellery, decorations and any small areas where immersion seems unnecessary. Always keep the solutions on the dilute side and allow the colours to build up.

Reducing Work. It is possible to reduce the work considerably by using masks. The Rossite kit includes a supply of Mountac, which is a solution that remains permanently tacky. Paint it on waterproof or greaseproof paper and one has a transparent adhesive sheet which will adhere to photographic paper, but strips easily. The Mountac must dry out before using it as a mask ; some 10 minutes is required.

If toning a large portrait, the procedure is :
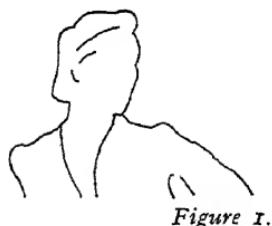
Figure 1.
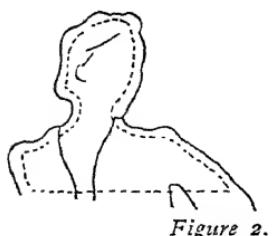
Figure 2.

Figure 3.

First. To protect the figure. Place the Mountac sheet you have just made over your print. Trace about $\frac{1}{8}$ in. within the area to be protected. Remove the Mountac and place it on a piece of glass or wood. Cut out the shape with a sharp knife or razor blade. Peel this away and place over the figure, pressing the paper down firmly.

Second. Now paint inside the figure with resist, and over the Mountac edge.

Third. Steep the print in the blue tone or whatever colour your background is to be and remove when satisfactory. Peel off the masking paper and rub away the resist. Keep the masking paper by putting it on to an old print. It can be used again.

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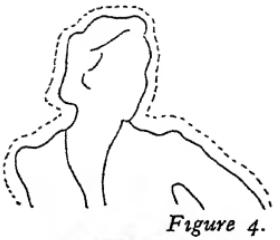
Figure 4.

Figure 5.

Fourth. Now take the part of the Mountac paper that was left when the figure mask was taken away. Place it over the print, which should be dried first. Trace again as in Fig. 4 and cut to shape. Press firmly.

Fifth. " Resist " the parts in black. Note the eyes must be protected as well. Steep in the flesh-tint solution. Then remove the Mountac, resist, and wash thoroughly. This final wash is always necessary as it makes for even shrinkage of the paper, resulting in a flat print when dried.

COLOURTONE WITH OTHER MEDIA

You need not confine yourself entirely to colourtone . A combination of the above with chemical toning is capable of very effective results. For example, the red toner as supplied by Johnson's in their Pactum Series makes a delightful flesh tint if the print is left in the toner for about 3 minutes. Eyes and teeth can be protected by the resist, and then, by the use of colourtones, dress and background can be dealt with.

Special Effects. Sepia can also be effectively introduced, providing sun-tanned effects. A seascape toned first by the sepia process and then immersed in blue colourtone gives a very natural result.

Woodland scenes will be improved by a light wash of one of the colourtones for the general tint. When immersed in a very dilute solution of Rossite Yellow the print takes on a pleasing glow of sunlight.

With colour development, as described in Chap. XVII, some delightful effects can be obtained by the combination of colourtoning and colour development, the resist being used to keep parts of the print immune during the process.

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The Flexichrome Process

An extremely ingenious method of making coloured photographic prints has been introduced in America by Mr. Crawford, a New York photographer. This starts with a print on a transparent Flexichrome film, which, after development, is bleached and finally treated with hot water until the soft gelatine is washed away, leaving only that bearing the image.

The next step is to dye the image black with the special dye provided and when the right type of print has been obtained (for this black dyeing affords an opportunity to control density and contrast) the film is backed with liquid paper, which, when dry, gives it the necessary support and provides a white background.

A kit of twelve liquid colours is supplied. When any of these colours (or combination of them) are applied with a brush to the black dye forming the image, they etch away the dye and replace it with the chosen colour—the brilliance and saturation of the final tone being dependent on the extent to which the black dye is removed.

When colouring an ordinary black-and-white bromide print the black image remains there all the time, and, when the shadows are heavy, the silver deposit must degrade any

transparent colours laid over it, but it will be seen that with Flexichrome there need be no degradation ; alternatively, the all-black image can be left or only slightly modified where it is required to give drawing or modelling.

Colours can be changed at will. If it is desired to alter a colour, the new colour can be applied over the old, and the first colour will be gradually removed and replaced by the new.

CHAPTER X
Toning : An Introduction

TONING, unlike colouring and tinting, is a chemical process by which the colour of the silver image is changed.

The purpose of any picture is primarily to create an illusion ; it intends that the viewer's mind should instantly visualise the scene depicted. In direct vision the subject matter is conveyed to the brain instantaneously ; colour, motion, and stereoscopic sight transmit everything at a glance, but when the effect has to be obtained from a small flat surface of monochrome light and shade, there is a time lag for optical adjustment and mental digestion. A black-and-white print offers a serious obstacle to a rapid appreciation of the motive of the picture, for the eye has to translate it first into colour and then into form. Think of the optical agility the eye needs to conceive the delicate pale-green tracery of spring foliage from its cold, callous presentation in a blue-black bromide, or of the difficulty of conveying by a black-and-white print the blue of the Mediterranean to anyone who has not seen it.

But in a photographic print we can, and should, make the journey from the eye to the brain shorter and easier by presenting it in a tone which will be, at any rate, a stage nearer to the original scene than are plain black and white.

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Sepia-toning processes we have always had, and these with their range through all the browns will make nine out of ten prints more attractive, but it is to the possibilities of all the more cheerful colours that the writer would like to draw attention. By the newer processes it is possible to replace the silver image by one of almost any of the colours in the spectrum, and if photographers will experiment with some of these they will discover a new interest in their work and another aid to the expression of their individuality.

There are a number of toning processes producing results of varying quality on different emulsions, but they are all based on one or other of the following procedures :

(*i*) *Direct Development* in which, by suitably adjusting exposure time and developing formulæ, a variety of tones from warm black to a red chalk can be obtained. Whilst very beautiful tones can be got this way (especially on chloride and chloro-bromide papers) there is only slight control, as the colour and " quality " of the print is largely dependent on the character of the negative.

(*ii*) *Development* or *Re-development*, with a developer containing a chemical agent which will change the normal silver image into one consisting primarily of a coloured dye. With this process, of which there are several variations, one can get a print in almost any shade or intensity of any desired colour.

(*iii*) *Chemical Toning.* This, the oldest of toning processes, involves a chemical conversion of the black silver image into one or more insoluble compounds having various colours ; with it, browns, reds, greens, or blue tones can easily be obtained. But it should be noted that the conversion of the silver image into a different substance involves a change in the value of the densities, and either intensification or slight reduction may result. Until experience has been gained it may not be easy to obtain just the depth required.

There are, as has been said, many variations of each of these methods, and in the following pages will be found detailed instructions for the working of all those which have stood the test of practice. There are other methods of toning prints, but as some of these are only of laboratory interest, or freakish in character, they are not described here.

CHAPTER XI

Toning Printing-Out Papers

PRINTING-OUT paper (P.O.P.) has gone out of fashion, but the purpose of this book would not be served if the methods of toning this material were not briefly described. The formulæ given later can be used on papers with either a gelatine or collodion base, and serve equally well on home-made plain salted papers. All these, if left untoned, give a disagreeable yellowish-brown image. This is remedied by substituting another metal for a portion of the silver forming the printed image or by converting it into a more pleasantly coloured compound. Prints on any P.O.P. must be on the dark side before they are taken from the printing frame as they lose in strength during fixing.

PROCEDURE

The first procedure after printing is to wash out of the paper as much as possible of the unaffected silver, and this is done by soaking the prints in several changes of water. At first the water will be very " milky," but the milkiness will disappear after four or five short soakings in fresh water, or by keeping a flow of water through the dish while constantly turning the prints over. When the washing water shows no further discoloration, the prints are ready to go into the toning bath.

The purpose of the toning bath is to deposit gold on the silver image and this is effected by bathing the print in a solution of gold chloride activated by another chemical. The most popular formula is the following, which is made up in two separate solutions and later mixed and diluted with water as required.

SOLUTION A

Ammonium sulphocyanide	...	200 grs. or	12 gms.
Water	...	...	...	...	20 ozs. ,, 500 c.c.

SOLUTION B

Gold chloride	...	...	...	15 grs. or	1 gm.
Distilled water	...	...	...	20 ozs. ,, 500 c.c.

As the sulphocyanide crystals have a great affinity for moisture they must be kept in well-stoppered bottles. The gold chloride is sold in glass tubes containing 15 grains and the usual practice is to drop one of these into a bottle containing 20 ozs. of distilled water and then break it with a glass rod—broken glass will do no harm if left in the bottom of the bottle.

The working bath is made up as follows:

Water	...	...	16 ozs.
Solution A	...	2 ,,
Solution B	...	2 ,,

and the prints, after the preliminary washing already mentioned, are placed in it and kept moving till the desired tone is reached.

A number of prints can be toned at the same time provided they are not allowed to cling together. A good plan is continually to transfer the bottom print to the top of the others; this ensures even exposure to the action of the solution and prevents the formation of air bubbles.

Varying the Colour. It should be remembered that the number of prints which can be toned and the colour they reach is determined by the amount of gold in the bath. In time this will be exhausted and toning will cease till more

gold is added. The amount of gold given in the formula for the bath provides for the normal " photographic brown," but by varying the strength of the gold in it, any colour from a purplish black to a deep sepia is obtainable.

As the prints reach the required colour, they can be thrown into a bath of clean water and left there till all the others are ready for the wash before fixing. This washing takes only about 5 minutes in several changes of water. One must be careful that no trace of hypo gets into this washing water or yellow stains will appear on the final prints.

Fixing. The fixing bath for P.O.P. should be a plain solution of hypo—say, 3 ozs. to 20 ozs. of water—in which the prints are left for about 10 minutes. The final washing should be very thorough if permanence is desired ; say, for 2 hours in running water, the prints being kept separated.

There are other toning agents which can be used on P.O.P., such as Thiourea, Platinum or Selenium, but these are of academic rather than practical interest.

COMBINED TONING AND FIXING OF P.O.P.

The operation of toning and fixing *can* be combined in a single bath, but the practice has little to recommend it, as the choice of tone is limited and the permanence of the print is less assured. For those who care to try it, the following instructions given by Clerc in his *Photography : Theory and Practice* are quoted.

The following solution is first prepared :

Hypo	...	4 ozs.	or	200 gms.
Alum	...	130 grs.	,,	15 ,,
Lead acetate *or* nitrate ...	...	18 ,,	,,	2 ,,
Water up to	...	20 ozs.	,,	500 c.c.

The three solids are dissolved separately ; the alum and hypo solutions are brought to the boil and mixed whilst boiling. After complete cooling, the solution of the lead salt is added. It is allowed to stand for several days and then filtered. Shortly before treating the prints, the required

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quantity of solution is taken and a 1 per cent. solution of gold chloride is added to it in the proportion of one to twenty volumes of the stock solution. Clerc recommends that, as far as possible, a quantity of solution greater than is necessary for the prints to be treated should not be used, and that a fresh bath should be employed for each batch of prints.

If the prints tone very quickly in this bath, it is desirable to give them a further treatment in a plain hypo solution to ensure complete fixation. After fixing, they must, of course, be washed in the usual way.

Warm Tones by Development Alone

THE easiest way to get a change from the conventional black-and-white image is to make prints on one of the chloride or chloro-bromide papers, and produce the tone required by direct development.

TONES BY DIRECT DEVELOPMENT

The emulsion coating of sensitised papers contains millions of microscopic grains of a silver salt evenly distributed in a layer of gelatine over the entire surface. After light action by printing, the exposed parts are reduced by development to equally microscopic grains of metallic silver, and the unexposed parts are cleared of the unwanted silver salt remaining by the process known as fixing. The tone or colour of such a developed-out image is determined by the state of division of this silver deposit, whatever type of paper is used. If this deposit is fine, the tone colour is warm ; if coarsely deposited, then it is cold or blue-black. Chloro-bromide emulsions give a finer grain deposit than bromide emulsions, hence the reason for the former giving warm blacks and the latter more or less blue-blacks.

The characteristic image tone of any sensitised paper is that obtained by normal manipulation in the developer

formula recommended by the manufacturers. This tone can be varied, in the case of bromide emulsions to a limited extent, and in the case of chloro-bromides to a very great extent.

Chloro-bromide emulsions receive additional help in giving a fine-grain deposit by being developed in highly restrained developers, warm brown to red tones being possible according to the type of developer and amount of restraint used.

Bromide papers do not lend themselves to this treatment, and, except for a small latitude in exposure and development time, are best developed for their normal blacks, any desired warmer tone being obtained by after-treatment.

Printing-out papers behave in a similar manner, with the difference that the silver salt is reduced by the action of light alone. Such papers, when exposed to strong and rapid light action, will yield a much warmer result than that obtained with a weak and prolonged exposure.

Warm Tones—Kodak Formulæ. A unique range of tones from brown-black to red-chalk can be obtained on " Kodak " warm-tone papers by the use of various developers recommended by Kodak Ltd. for these papers. Four such formulæ are worth notice :

" KODAK " NO. I WARM-TONE DEVELOPER (D.166)

" Elon "	...	...	...	40 grs.	or	1·15 gms.
Sodium sulphite (cryst.)	...		4 ozs.	,,	50	,,
Hydroquinone	...	...	300 grs.	,,	8·5	,,
Sodium carbonate (cryst.)	...		5½ ozs.	,,	68	,,
Potassium bromide	...	...	1 oz.	,,	12·5	,,
Water to make	...	...	80 ozs.	,, 1000	c.c.

Dissolve the chemicals in the order given.

Use 1 part of developer to 3 parts of water.

This developer gives the maximum warmth of tone (short of red tone) on " Bromesko " and " Kodura " papers. Develop for 3 minutes at 65° F. (18° C.) : with this time

of development the correct exposure will give a first appearance of the image after about 50 seconds development. The warmth of image tone may be varied by increasing or decreasing the time of development with a corresponding decrease or increase in exposure.

"KODAK" NO. 2 WARM-TONE DEVELOPER (D.156)

"Elon"	...	...	...	60	grs.	or	1·7	gms.
Sodium sulphite (cryst.)	...			3½	ozs.	,,	44	,,
Hydroquinone	...		...	240	grs.	,,	6·8	,,
Sodium carbonate (cryst.)	...			3½	ozs.	,,	44	,,
Potassium bromide	...		...	220	grs.	,,	6·3	,,
Water to make	...		...	80	ozs.	,,	1000	c.c.

Dissolve the chemicals in the order given.

Use 1 part of developer to 1 part of water.

This is a medium warm-tone developer for "Bromesko" or "Kodura" paper. The normal development time is 2 minutes at 65° F. (18° C.).

KODAK "KODUROL"-HYDROQUINONE DEVELOPER (D.159)

Sodium sulphite (cryst.)	...		...	4	ozs.	or	50	gms.
"Kodurol"	...		...	140	grs.	,,	4	,,
Hydroquinone	...		...	250	,,	,,	7	,,
Sodium carbonate (cryst.)	...			5½	ozs.	,,	70	,,
Potassium bromide	...		...	35	grs.	,,	1	gm.
Water to make	...		...	80	ozs.	,,	1000	c.c.

Dissolve the chemicals in the order given.

For use dilute 1 part of developer with 2 parts of water.

This developer gives red tones on "Kodura" paper. Exposures should be adjusted so that development is complete in the time required to reach the desired tone.

The D.155 preceded the D.166 as the Kodak No. 1 Warm-Tone Developer. Although the latter formula is preferable as a general recommendation, the earlier formula gives a distinctive tone which may appeal to individual workers.

"KODAK" DEVELOPER (D.155)

"Elon"	20	grs.	or	0·6	gm.
Sodium sulphite (cryst.) ...	5¼	ozs.	,,	65	gms.
Hydroquinone	220	grs.	,,	6	,,
"Kodurol"...	150	,,	,,	4	,,
Sodium carbonate	6	ozs.	,,	75	,,
Potassium bromide... ...	220	grs.	,,	6	,,
Water to make	80	ozs.	,,	1000	c.c.

Dissolve the chemicals in the order given.

Use 1 part of developer to 2 parts of water. Develop for 2-2½ minutes at 65° F. (18° C.).

Increased exposure and further dilution of the developer extends the range of tones available from brown to red-brown.

The Kodak formula D.155 affords remarkable latitude in processing all chloro-bromide papers. A full-bodied type of negative is desirable, and the various tones are produced simply by varying the time of exposure and development. Thorough fixing and washing are essential. Prints of a very warm colour change tone considerably in the fixing bath, but this should be ignored as their final colour is only apparent when they are dried.

To ascertain the remarkable exposure and development latitude possessed by most makes of chloro-bromide papers, the following experiment in the above warm-tone developer is suggested.

If the correct exposure is, say, 10 seconds for a development time of 2½ minutes at 65° F., make test exposures of 2, 4, 6, 10 and 20 seconds and develop all five irrespective of time, until correct depth of image is reached.

It will be found that the prints will reach finality in the following approximate times :

20 seconds exposure	...	...	...	2	minutes
10 ,, ,,	...	...	...	2½	,,
6 ,, ,,	...	...	...	4	,,
4 ,, ,,	...	...	...	6	,,
2 ,, ,,	...	...	...	12	,,

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On examination after drying, it will be found that the centre three could very well be matched up for one order, the 12 minutes' developed print being slightly brighter, and of less warmth, and the 2 minutes' developed print slightly softer and warmer, but both exceptionally good prints.

Obviously, care must be taken to shield prints from excessive exposure to safelight during prolonged development. After this, one may experiment with various dilutions to arrive at a complete understanding of the control possible with this unique and almost foolproof developer.

Ilford Formulæ. For their Clorona (Chloro-Bromide) papers, Ilford Ltd. recommend a developer containing chlorquinol which may be made to give tones from warm black right through to bright red. Here are the formulæ :

CHLORQUINOL M.Q. DEVELOPER
For warm-black to sepia

Metol	...	...	10	grs. or	0·5	gm.
Chlorquinol (or Adurol)	...		¼ oz.	,,	6·2	gms.
Hydroquinone	...	...	¼ ,,	,,	6·2	,,
Sodium sulphite (cryst.)	...		4 ozs.	,,	100	,,
Sodium carbonate (cryst.)	...		4 ,,	,,	100	,,
Potassium bromide	...	...	15	grs. ,,	0·8	gm.
Water, up to	...	...	80	ozs. ,,	2000	c.c.

For warm-black, 1 part of developer is mixed with 3 parts of water, and for sepia the exposure should be increased by about 50 per cent. and the developer diluted with 6 parts of water. Development takes about 2 minutes at 65° F.

Sepia to bright red

Chlorquinol (or Adurol)	...		60	grs. or	3·4	gms.
Hydroquinone	...	...	60	,,	3·4	,,
Sodium sulphite (cryst.)	...		2½ ozs.	,,	62·5	,,
Sodium carbonate (cryst.)	...		2½ ,,	,,	62·5	,,
Potassium bromide	...	...	6	grs. ,,	0·35	gm.
Water up to	...	...	20	ozs. ,,	500	c.c.

With increasing exposure, greater dilution of developer, and with more potassium bromide, the colours produced range from sepia to bright red as indicated in the following table. Time of development may be from 2 minutes to 30 minutes according to the colour required. Development may be speeded up by using the solution at 70° to 80° F.

COLOUR CONTROL   *Using above developer at 65° F.*

Colour	Exposure		Dilution of Developer		Extra 10% Pot. bromide Solution per oz. (25 c.c.) of stock Developer			Approx. Development time in mins.
Warm-black	Normal		Full strength		None			$1\frac{1}{2}$
Sepia ...	3 times		10 times		20 minims	(1 c.c.)		5
Brown sepia	5	,,	15	,,	60	,,	(3 c.c.)	10
Red-brown	6	,,	25	,,	100	,,	(5 c.c.)	15
Bright red	7	,,	30	,,	120	,,	(6 c.c.)	20

If a warm-black is desired it is better to use one of the first-mentioned developer containing Metol.

JUDGING COLOUR

When developing prints in the yellow light of the dark room it is difficult to judge the very warm colours correctly. Actually the colour of the wet print is not the same as that which comes after drying, but experience will enable the worker to make allowance for the change. A white inspection light, containing a frosted lamp of about 5 c.p., permits a rapid inspection of the progress of development. The lamp must not shine on the work-bench or cause fog on the paper.

The tone depends on the composition and temperature of the developer and on the time of development and the same conditions as obtained for the test print must be correctly duplicated when making the batch of prints. Similarly, the conditions applying to a particular tone for a negative will be the same for the same tone for another negative, but the exposure must be carefully adjusted to give the required strength of print under these development conditions.

This addition to warm tone developers has considerably simplified printing as it is a highly concentrated solution which needs only the addition of water for use. It gives all the tones between warm-black and sepia.

GLYCIN DEVELOPER

Unlike most developing agents this does not produce fog when the unfixed prints are exposed to the air ; it is therefore useful for large prints which may have to be taken out of the bath for local treatment. The following formula gives sepia to warm-black tones on chloro-bromide and gaslight papers and warm-black prints on ordinary bromide.

Solution A

Soda Sulphite Cryst.	...	2	ozs.	or	50	gms.
Soda Carbonate Cryst.	...	$\frac{1}{2}$	oz.	,,	12·5	,,
Glycin-Johnsons	...	$\frac{1}{2}$	,,	,,	12·5	,,
Water to	...	20	ozs.	,,	500	c.c.

Solution B

Soda Carbonate Cryst.	...	4	ozs.	or	100	gms.
Potassium Bromide	...	10	grs.	,,	0·5	gm.
Water to	...	20	ozs.	,,	500	c.c.

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CHAPTER XIII

Chemical Toning

WHILST the cold blue-black print which most bromide papers give by normal exposure and development can be warmed up somewhat by increasing the exposure and correspondingly restraining or diluting the developer, the operation requires careful attention to detail as it is not easy to secure uniformity of tone in prints from negatives which differ much in character. Very beautiful warm-tone prints can be produced by development alone on chloride and chloro-bromide papers, but these are very slow compared with ordinary bromide paper, and this is a serious objection when projection printing is employed or when enlargements are required. A wider range of tones can be secured with more certainty and less skill by one or other of the chemical toning processes, and it is an advantage to see what a print looks like in black-and-white before deciding on its final colour.

It must be borne in mind that the final colour obtained by any after-toning process will still be largely dependent upon the character of the black-and-white print. If the original has only a thin surface image as a result of over-exposure and under-development, any following tone will be weak and probably unpleasant. It is rare for a technically bad print to be improved by toning except when the operator

is aiming at some weird effect. A print which is being made with after-toning in mind should have the exposure which requires it to be developed right out so that it has a good deposit of silver in its heavier parts. A normal developer must be used ; one which has been diluted or restrained with an excessive amount of bromide must not be used when toning is intended.

The type of emulsion has an important bearing on the final colour obtained ; fast chloro-bromide papers, for instance, provide warmer tones than bromide. Slow chloro-bromides are not recommended for toning, as their characteristic is beautiful warm-black tones by straightforward development. With bromide emulsions, the slower papers give warmer sepia tones than the faster papers, and contrast emulsions tend to give cold sepias. Gaslight papers *can* be toned, but it seems a purposeless proceeding when their best qualities can be brought out by direct development : if, however, it is desired to try another colour on them, only those with a fully developed image should be used or ginger tones will result.

Printing papers of the Bromesko and Plastika order are in a class by themselves and toning formulæ suitable to the ordinary bromide papers do not always work with them. Recommendations for their treatment will be found on page 75.

SURFACES AND TONES

The surface of the papers used has some effect on the tone obtainable ; matt surfaces, for instance, tend to give colder tones than glossy prints, even though they are coated with the same emulsion. A good sepia can be got on a matt surface paper provided the time of development has not exceeded that which would be necessary for a good black-and-white result, but on a semi-matt or a glossy surface the print should be left a little longer in the developer. In

nearly every case a slightly darker print should be made when after-toning is intended.

FIXING

Prints that are to be toned must be fixed in a *clean* hypo bath or all sorts of unpleasant stains and markings will result. This is also true of a bath that has been too long in use and especially of one which has become alkaline from developer carried over with prints. Blue smudges, purple tones, yellow stains and uneven toning can nearly always be traced to a worn-out fixing bath or to the prints not being kept moving when in the hypo.

Prints fixed in a bath acidified with citric or acetic acid will give slightly warmer tones than if plain hypo is used ; those containing metabisulphite have no effect on the final colour with the majority of papers.

From all the foregoing it may be seen that toning will not disguise the defects of a bad black-and-white print ; rather will it exaggerate them. Whites must be white and blacks black ; a grey veil which may be scarcely noticeable on a black-and-white image may look like a yellowish fog on a sepia print, and a dark grey which may pass for black on a bromide will have little body in it when translated into a less vigorous colour.

Sulphide Toning Processes

THE most popular toning processes practised have hitherto been based on the conversion of the black silver image into one of silver sulphide. The sulphide image can be produced in a number of different ways and on these will depend its final colour. This colour will always be some shade of brown, but there is a surprisingly large range of these browns between what is almost a yellow and nearly a black. A silver sulphide print is as nearly permanent as any photograph can be, for sulphur, which is the greatest enemy to photographic materials, has done its worst and there is nothing much else which can affect it.

It should be noted that although sulphide toning can be applied to some makes of chloro-bromide paper it may not work at all with others and the following recommendations must be taken to apply to prints on the conventional bromide papers only.

There are two methods of converting the normal black silver image of a bromide print into one of silver sulphide :

The Direct Method of treating the print with chemicals which will change the metallic silver into sulphide without any intermediate steps ; and *The Indirect Method* by which the

original image is converted into a silver compound which can readily be changed into silver sulphide.

Before describing these processes the reader should be warned that in their working, hydrogen sulphide gas is generated. This gas, besides having a most objectionable smell, will fog any sensitised photographic material it reaches. Sulphide toning should therefore be carried out somewhere well away from the place where such materials are stored. The smell can to some extent be destroyed by the plentiful use of potassium permanganate round the sink and on the bench where the work is being done.

DIRECT SULPHIDING

HYPO-ALUM

In the direct process the tone is produced gradually as the metallic silver is converted into a silver salt. There is a double reaction taking place all the time, and if these are not both carried through to finality it may be that the resulting print will be less pure in colour and of less certain permanency. The direct process also requires the solution employed to be kept up to a fairly high temperature, and all makes of printing paper will not stand up to this. Abrupt changes of temperature must be avoided or blistering and frilling will result ; the prints must be allowed to cool off before they are taken from the hot bath and plunged into cold washing water. Direct sulphiding baths *can* be used cold, but in that case the toning will take anything from 12 to 24 hours to complete.

HYPO-ALUM BATH FOR DIRECT TONING

Hypo.	...	...	...	3 ozs.	or	75	gms.
Potassium alum	...	...		½ oz.	,,	12·5	,,
Boiling water up to		...		20 ozs.	,,	500	c.c.

The hypo must first be dissolved in the hot water and the alum added gradually, stirring all the time. When the alum is dissolved, boil the mixture for 2 or 3 minutes and then allow it to cool. The solution will be very milky owing to

the liberation of sulphur, but this can be ignored as the clear
liquid is decanted after the sediment has settled down.

RIPENING THE HYPO-ALUM BATH

The prints toned in this bath will be very raw in colour
and slightly reduced in depth unless the bath has been
" ripened " by adding silver nitrate to it. This is done by
dissolving about 5 grains of silver nitrate in about 1 oz. of
water (the quantities are not important) and adding just
sufficient ammonia to re-dissolve the precipitate formed.
When the toning bath is cold this ripener should be added
to it and the whole mixture shaken for a minute or two and
then allowed to stand for several hours.

If no silver nitrate is available, the bath can be ripened by
putting half a dozen waste bromide prints into it (using a
dish big enough to take the whole bath) and leaving them
there for 12 hours or so. That will have the same effect
as adding the silver solution.

It may be mentioned here that a new bath is never at its
best. A hypo-alum bath is improved by use and only needs
keeping up to its original bulk by the occasional addition of
fresh solution. Only when it ceases to tone satisfactorily
need it be thrown away.

Prints for toning by this method should be fixed in the
usual way, but do not need more than a good rinse after
leaving the hypo and before being put in the toner.

As the toning bath must be hot if it is to do its work in a
reasonable time, the dish containing it should be placed in a
larger bath filled with water which can be kept hot by a
gas ring or with an electric immersion heater. A thermometer
should be used, as it is necessary to keep the solution at an
even temperature of 120° F. At this temperature, prints
will take up to about 10 minutes to tone, but the time will,
of course, depend on the depth of colour required.

The bath should be decanted from its storage bottle into
the dish and never filtered, leaving always the precipitate
at the bottom of the bottle.

When the prints have reached the desired tone, they should be taken out and put in tepid water which is gradually cooled before they go into the final washing water. But before they are quite cooled off, they will need sponging over to remove any sediment that may have settled on them. A further sponge down after the final washing is also desirable. This final washing should be for not less than half an hour in running water.

A new and only partially ripened hypo-alum bath will give warm sepias on normal bromide papers, but the prints will be reduced in depth. A well-used bath has only a slight reducing action and gives prints much colder in tone. If warmer tones than those which the bath normally gives are required, these can be obtained by adding 10 grains of potassium iodide to the toning solution.

If blisters appear during toning, it is an indication that the brand of paper used needs pre-hardening, and any other prints made on it should be fixed in an acid fixing and hardening bath. If the blisters do not appear till the prints are in the washing water, they are caused by too sudden a drop in temperature on removal from the hot toning bath. If prints are patchy, it is probably because they have stuck to one another in the hypo-alum. The remedy is obvious, they must be frequently moved about during the toning operation.

CONTROLLED HYPO-ALUM

With the ordinary hypo-alum process there is practically no control over the final colour, as this is determined almost entirely by the quality of the print in its black-and-white stage. But a measure of control can be obtained, and a much richer colour ensured, by using a formula worked out by Zanoff, in which he uses two solutions :

SOLUTION I

(a) Hypo	...	...	...	20 ozs.	or	143	gms.
Alum	...	...	...	2 „	„	14·3	„
Boiling water (distilled)	...	28 „	„	1000	c.c.

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Boil for 2 minutes, when cool add :

(b) Sodium sulphate	...	...	2 ozs.	or	14·3	gms.
Silver nitrate	...	...	60 grs.	,,	0·95	gm.
Water	...	...	1 oz.	,,	7·8	c.c.
Potassium bromide		...	180 grs.	,,	2·85	gms.
Water	...	...	1 oz.	,,	7·8	c.c.

Pour the bromide into the silver solution (with the precipitate) and add to the cool hypo-alum solution.

(c) Gold chloride	...	...	15 grs.	or	0·24	gm.
Water	...	...	2 ozs.	,,	15·6	c.c.

Add this to the hypo-alum bath.

SOLUTION II

(a) Hypo	...	...	...	16 ozs.	or	114	gms.
Alum	...	...	...	4 ,,	,,	28·5	,,
Water	...	...	...	128 ,,	,,	1000	c.c.

Boil for 5 minutes, cool, and add the following previously prepared solution :

(b) Silver nitrate	...	...	30 grs.	or	0·48	gm.
Potassium bromide		...	30 ,,	,,	0·48	,,
Water	...	...	1 oz.	,,	7·8	c.c.

These two baths should be put in separate dishes and the prints placed first in one and then in the other. Solution I need only be lukewarm, but Solution II must be kept in a temperature of round about 120° F.

The final tone will be determined by the relative times they are left in each. The longer they are subjected to the action of No. 1 the colder will be the final tone, and vice versa. Thus it is possible, by ringing the changes between the two baths, to get anything between a yellowish brown and a warm black.

HYPO-ALUM AND GOLD

When gold chloride is added to a hypo-alum toner, the most beautiful sepias, which are not surpassed by any other photographic printing process, can be obtained. Compared

with other toning formulæ the cost may be high, but the results are incomparable. Henney & Dudley, in their *Handbook of Photography*, give the following formulæ :

SOLUTION I

(a) Boiling water (distilled) ... 128 ozs. or 4000 c.c.
Hypo ... ... 16 ,, ,, 450 gms.
Potash alum ... ... 2 ,, ,, 56 ,,

Boil the above for 2 or 3 minutes, allow to cool, and then add :

Sodium phosphate ... 2 ozs. or 56 gms.

Test the resulting solution with red litmus paper. If the litmus paper does not turn blue within one minute, heat the bath again and add sodium phosphate in 2-oz. (56 gms.) quantities until the bath has become slightly alkaline. Then dissolve :

(b) Silver nitrate ... ... 60 grs. or 4 gms.
Water ... ... 1 oz. ,, 30 c.c.
Potassium bromide ... 120 grs. ,, 8 gms.
Water ... ... 1 oz. ,, 30 c.c.

Separate solutions are made of the silver nitrate and bromide, each dissolved in 1 oz. (30 c.c.) of water. The bromide is poured into the silver nitrate solution. The resulting mixture, precipitate and all, is then added to the hypo-alum bath after the latter has thoroughly cooled.

SOLUTION II

Gold chloride ... ... 15 grs. or 1 gm.
Water ... ... 1 oz. ,, 15 c.c.

To use, add 1 dram (3·7 c.c.) of Solution II to each 16 ozs. (500 c.c.) of Solution I.

Tone at a temperature of 90° F. to 110° F., but not more than 110° F. Prints should be examined as toning proceeds and removed when the desired tone is reached.

The most economical bath one can use for direct toning is made with a plain solution of sulphur. With this solution excellent deep sepia tones can be obtained on some grades of bromide paper, but with others its action is uncertain. It is necessary, however, to obtain the sulphur from a reputable firm, as much commercial sulphur has impurities which render it unfit for photographic purposes.

STOCK SOLUTION

| Liver of sulphur | ... | ... | 2 ozs. | or | 50 gms. |
| Hot water ... | ... | ... | 20 ,, | ,, | 500 c.c. |

WORKING BATH

Stock solution	...	...	½ oz.	or	12·5 gms.
Water ...	...	...	80 ozs.	,,	2000 c.c.
Ammonia (0·880) ...	...	20 drops	,,	1	,,

The bath should be used at about 80° F., and at this temperature a bromide print is toned in about 10 minutes. Chloro and chloro-bromide papers tone more quickly—in about 5 minutes. Prints should be removed from the bath before they have reached the colour desired, as toning continues whilst they are in the washing water and until all the sulphur is washed out. The colour tends to change whilst the print is drying, so it is desirable to experiment with this bath before risking a valuable print in it. As liver of sulphur has a softening effect on the emulsion, it is necessary that prints intended for toning in it should be fixed in a bath of the fixing-hardening type. Prints must be washed till any discoloration of the whites is completely removed.

TONING WITH ACIDIFIED HYPO

The sulphur necessary to change the black-and-white silver image into a brown one can be produced very easily, simply by adding an acid to hypo solution, and a number of toning processes have been based on this reaction. The same result can be obtained in a number of ways, but the

one which the writer has found most effective is first thoroughly to acidify the print by soaking it for 10 or 20 minutes in a 5 per cent. solution of sulphuric acid, and to follow, after a brief rinse, with a bath composed of a 20 per cent. solution of hypo, saturated with borax (*Neblette*). Alternatively, *Clerc* recommends that the black-and-white print be first immersed in a plain solution of hypo—about 20 per cent.—and then transferred from that to a very weak solution of hydrochloric acid—about 1 per cent. The print has to remain in this latter bath for at least half an hour, or there is a risk that the final colour will not be the same throughout. The final colour is only obtained after washing for about an hour and a half.

CHAPTER XV

Indirect Sulphiding

THERE are a number of variations of this process and most of them involve two separate operations : the black-and-white print is *bleached* in one bath and *toned* in another. The potassium ferricyanide formula given here is the conventional one :

BLEACHING

STOCK BLEACHING SOLUTION

Potassium ferricyanide	...	1 oz.	or	25 gms.
Potassium bromide...	...	1 ,,	,,	25 ,,
Water up to	... ...	10 ozs.	,,	250 c.c.

This solution must be kept in the dark. For use, take 1 oz. (25 c.c.) of the stock and make up to 10 ozs. (250 c.c.) of water.

In this the prints are bathed until the black image is changed to a faint yellowish brown—an operation which takes anything from 4 to 10 minutes, depending on the class of printing paper. If the whole of the silver image is not bleached right through, the final print will show double tones, the light tones being formed entirely of sulphide and the darker parts of a mixture of the brown sulphide and the black silver of the original image. Advantage of this is

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sometimes taken to get unusual effects, but the success or otherwise of this trick will depend on the skill of the operator. After bleaching, the prints must be washed, but only for a few minutes, as prolonged washing at this stage tends to give the toned print a yellowish tinge.

TONING

After the rinse they are toned in the following bath :

STOCK SULPHIDING SOLUTION

Sodium sulphide	...	...	½ oz. or	12·5 c.c.
Water up to	...	...	10 ozs. ,,	250 ,,

The sulphide should be dissolved in water which has been boiled and cooled. For use, take 1 oz. (25 c.c.) of the stock solution and dilute with 10 ozs. (250 c.c.) of water. Throw away after use and make up fresh working bath for each batch of prints. Wash well after toning.

This method of toning gives sepias which will vary between cold and warm, depending on the grade of paper used for the black-and-white prints and on the way they have been developed. In the toning procedure there is no control over the colour obtained ; if the print has been over-exposed and snatched out of the developer before the blacks of the image were fully developed, then the toning bath will give an unpleasant brownish yellow. If, on the other hand, the print has been under-exposed and forced in the developer, toning will turn the image into a cold sepia. Usually the softer grades of bromide paper give warmer tones than the harder grades. Less bromide in the bleaching bath, say, a quarter of the weight given in the above formula, will give warmer tones on any papers.

If, after indirect sulphide toning, there is any stain on the white parts of the print, this can be taken, not as a fault of the toning process, but as a certain indication that the black-and-white print was not completely fixed. Two fixing baths, the second one freshly made, should always be used on prints intended for indirect toning. If hypo-alum is employed, this is not necessary

The operations of bleaching and re-development should be carried out in artificial light—not daylight.

A *bleacher* which will give colder tones than ferricyanide-bromide on papers which tend to the warm side is taken from the *B. J. Photographic Almanac*:

Sodium phosphate ...	...	200 grs. or	13 gms.
Potassium ferricyanide	...	40 ,, ,,	3 ,,
Water	...	4 ozs. ,,	135 c.c.

But whatever bleacher is used, the writer has found that cooler tones are obtainable on any brand of paper if, after bleaching and washing, the prints are immersed for a few seconds in a 1 per cent. solution of sodium carbonate (followed by a rinse) before sulphiding.

TONE CONTROL BY INTERMEDIATE DEVELOPMENT

It has already been stressed that there is little control over the colour of the image in sulphide toning, as this is largely dependent on the way the black-and-white print is made, but the range of possible tones can be largely increased if, after bleaching, the print is partly re-developed in a weak M.Q. developer before sulphiding. If this is done, the resulting tone will depend on the length of time the intermediate developer is allowed to act on the image.

The purpose of this intermediate process will be understood if it is remembered that an ordinary bromide developer produces a black image whereas the sulphide picture is brown. If, then, the final print is made up of both black and brown particles, its colour will depend upon which of these predominates ; in other words, how much of the image substance is produced by the developer and how much is converted into brown silver sulphide. If, after bleaching, the print is only partly re-developed, and afterwards toned in the sulphide bath, the colder effect of the faint black deposit produced by the developer will be very slight. If,

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on the other hand, re-development is carried on right through the emulsion, then the black silver will form most of the image, which can be no more than just " warmed up " by the sulphide bath.

It will be seen, therefore, that a considerable measure of control over the final tone can be secured, but that it involves control over the developer. The bleached print, if placed in a bromide paper developer of normal strength, would be blackened right through in a matter of seconds and one would have no control ; but if the same developer is diluted with water to 15 or 20 times its volume, its action will be so slow that the operator will have plenty of time to study progress and take the print out when it has reached the stage which will give him the tone he desires in the final print.

As the developer acts more quickly as development proceeds and as the action goes on after the print is taken out of it, it is as well (especially if one has a batch of prints going through together) to transfer the prints direct from the developer into a stop bath (a 5 per cent. solution of acetic acid) where they can be left till all are ready for the wash before sulphiding.

It should be remembered that the very dilute developer recommended is weak in its reducing constituent and will, therefore, soon become exhausted ; it is therefore advisable to make it up for every few prints.

PRE-SULPHIDING

The normal sulphide tone obtained with any sensitised paper can be made appreciably colder by immersing the print in the usual sulphide solution for a short period *prior* to bleaching. About 2 minutes' immersion is sufficient to enable a rich sepia tone to be obtained on a print that would normally yield a rather foggy result.

Prolonged pre-sulphiding will eventually convert the whole of the silver image into silver sulphide, so that hardly

any noticeable change takes place in the bleaching bath. A print thus treated will be of the darkest brown colour. Pre-sulphiding can be used with advantage for the sulphide-toning of gaslight papers, which normally tone to a very warm colour, or for the darkening of chloro-bromide prints which have been developed in a restrained developer and consequently possess a warm-black image.

SULPHIDE-MERCURY

(*Bennett's Process*). A measure of control over the final tone can be obtained by the intermediate re-development method already described, but another process, introduced by Mr. H. W. Bennett, affords a wider range. In straightforward sulphide toning the ultimate colour of the print is determined by the balance of the silver (black) and the sulphide (brown) forming the final image, whereas in Bennett's process the image is formed by mercury sulphide, which is just as stable as silver sulphide but gives the rich black which one associates with an etching or an engraving.

Sulphide-Mercury Formulæ. The black-and-white bromide print is first bleached in a bath made up as follows :

SOLUTION A

Potassium ferricyanide	...	1 oz.	or	30 gms.
Potassium bromide...	...	1½ ozs.	,,	45 ,,
Water up to ...	...	9 ,,	,,	266 c.c.

SOLUTION B

Mercuric chloride ...	...	60 grs.	or	4 gms.
Potassium bromide...	...	60 ,,	,,	4 ,,
Water up to ...	...	5 ozs.	,,	150 c.c.

Solutions A and B when mixed form the bleaching bath and it is upon the relative proportion of the two solutions that the final tone largely depends. For instance, if 50 parts of " A " alone are diluted with 500 parts of water, a normal

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black-and-white bromide will be given a normal sepia tone, but if we add, say, 20 parts of solution "B" and reduce the quantity of "A" to 30 parts, the final print will be appreciably colder in tone. Thus we can go on slightly reducing the proportion of "A" and increasing "B" (keeping all the time the bulk up to 500 parts with water) till we reach the stage of a warm black and finally an engraving black. In other words, the larger the amount of mercury used, the blacker and colder the image.

The tones mentioned do not, of course, appear while the prints are in the bleaching bath, but it is by the composition of this that they are determined. When the prints are taken from the bleacher they must be given a rinse and passed through at least two 1 per cent. baths of hydrochloric acid.

After the acid bath the prints should be washed for 10 minutes and re-developed in the following solution :

Sodium sulphide	...	...	1 oz.	or	100 gms.
Water up to	...	...	9 ozs.	,,	1000 c.c.

A possible objection to this process lies in the fact that the mercury slightly intensifies the image, and this is likely to increase the opacity of shadows which are already on the heavy side ; but when experience has taught the operator what type of print lends itself best to this treatment, then it is capable of giving results which are hardly inferior to those obtainable with the carbon process.

COPPER TONER FOR PURPLE TO CHALK-RED

It is not possible to make a general statement about the colour produced by this toning method, because that depends largely upon the character of the emulsion on which the black-and-white print is made. Prints made on different makes of bromide paper which appear to be identical may tone to distinctly different colours : one may develop to a purple and another to a chalk-red. This does not mean that the bath is erratic in action ; it will tone the same brand of paper to the same colour every time, but it will not often

produce the same colour on any two brands under the same conditions. Therefore, the worker who wants to obtain, say, Bartilozzi Red, must himself make some experiments with different papers and different treatments before endangering a treasured print.

The following formulæ, taken from the *British Journal of Photography*, are characteristic of several that may be used :

SOLUTION A

Copper sulphate	...	...	60 grs.	or	6·25 gms.
Potassium citrate (neutral)		240 ,,	,,	25	,,
Water up to	...	...	20 ozs.	,, 1000	c.c.

SOLUTION B

Potassium ferricyanide	...	50 grs.	or	5·2 gms.
Potassium citrate	...	...	240 ,,	,,	25	,,
Water up to	...	...	20 ozs.	,, 1000	c.c.

For a working bath take equal parts of each of the above. Toning proceeds fairly rapidly and the action can be followed as the tones go through the browns till the final red or purple is reached.

This toner does not intensify the image and if the picture seems a little lacking in vigour, it may be strengthened, after a brief rinse, by bathing in a 5 per cent. solution of copper sulphate to which a few drops of hydrochloric acid have been added.

There is another copper-toning formula recommended by Namias in which the print is first bleached in the following :

Copper sulphate	...	...	614 grs.	or	80 gms.
Sodium citrate (neutral)	...	81 ,,	,,	10·5 ,,
Potassium ferricyanide	...	73 ,,	,,	9·5 ,,
Water up to	...	...	16 ozs.	,, 1000	c.c.

The prints, after going through this bleacher, must be well washed and then re-developed in any normal M.Q. developer which contains bromide. As this method has a slight intensifying action on the image it should be used only for prints on the light side.

Brown to Red Tones. With uranium (for which there are a number of formulæ) a range of tones from black through the browns to a yellowish-red are obtainable. It is a toner which appears to be erratic, but here is the formula of Dr. Sedlaczek, who has made a special study of this toning method :

Uranium nitrate	...	...	38 grs.	or	5	gms.
Potassium citrate	...	...	38 ,,	,,	5	,,
Potassium ferricyanide	...	15 ,,	,,	2	,,
Ammonia alum	...	...	77 ,,	,,	10	,,
Hydrochloric acid	...	...	2 mins.	,,	0·3	c.c.
Water up to	...	...	16 ozs.	,,	1000	,,

The print before being put in this bath must have been well washed so that all trace of hypo is removed, otherwise yellow stains will result.

Of this bath, Neblette says : " The colours produced with a bath of the above composition are far superior to those produced by the older methods, being darker and richer owing to the presence of some of the black silver image."

A yellow tint is generally left in the print base after toning with uranium, but this can be removed if desired (though it is not always unpleasant) with either of the following baths :

Hypo	...	...	...	1 oz.	or	50 gms.
Sodium acetate	...	...	90 grs.	,,	10	,,
Acetic acid (10% sol.)	...	1½ drs.	,,	10	c.c.
Water up to	...	...	20 ozs.	,,	1000	,,

or

Potassium citrate	...	...	38 grs.	or	5	gms.
Sodium sulphate	...	...	192 ,,	,,	25	,,
Water up to	...	...	16 ozs.	,,	1000	c.c.

The print may need several treatments with either of these clearing baths to remove the yellow colour entirely, and when this is effected it must be well washed and the final washing water should be acidified, say, by adding 10 minims of acetic or hydrochloric acid to 20 ozs. of water.

This paper, like others which incorporate chloride of silver in the emulsion, does not take kindly to some of the conventional sulphide baths but gives very pleasant browns with selenium sulphide (Kodak T.56) or rich purple browns with the T.55 formula, and for rich chocolate browns the Kodak hypo-alum formula T.51 is recommended. For these see page 115.

PLASTIKA

It is possible to obtain sepia tones on this paper by the Liver of Sulphur method. It is a straightforward process and the following procedure is recommended by the makers of this paper.

TONING BATH

Liver of Sulphur	...	...	60 grs. or	6·8 gms.
Water	...	...	...	80 ozs. ,,	4000 c.c.

Raise the temperature of the toning bath to about 80° F. and place the wet prints direct from the final washing water one by one into the toning solution. After toning they should be removed, washed and put to dry in the usual way. As the process makes the emulsion slimy and soft it is advisable, though not essential, to harden the prints before toning. A suitable method is to immerse them for 10 mins. in a 10 per cent. solution of formaline, followed by washing.

Colour Control. The colour of the toned image can be controlled to some extent by choosing a suitable combination of developing and toning time, as follows :

		Developing Time at 65° F.	*Toning Time at 80° F.*
For standard tones	...	1½ mins.	8 mins.
For colder tones ...	...	5 mins.	10 mins.

Selective Toning

DELICATE colour effects can be obtained by selective toning, and the following method is described by Mr. B. L. Twinn, A.R.P.S.

THE METHOD

Let us start with an untoned bromide print, say, of a pretty girl wearing a summer frock. Commencing with the print dry, and working with a fine-pointed brush, the face and other flesh portions are bleached out (with a ferri-cyanide-bromide bleacher), also any pattern of the dress for which a suggestion of a near red or pink effect is desired. The print is then rinsed under running water until the yellow stain of the bleaching solution clears, and is then transferred to the usual sulphiding solution. The untoned portions will at this stage appear to be blue, and the sulphided portions pink.

After washing the print for a few minutes, the surface should be blotted off with blotting paper or a wrung-out chamois-leather. Again using the spotting brush, the hair and other portions where a brown effect is desired should be bleached out. The print should then be rinsed as before,

partially re-developed (in a very dilute M.Q. developer as described on pages 95 and 96), rinsed and again transferred to the sulphiding solution.

The process is repeated until all the desired shades of tone are reached. With a little practice it is possible to produce very pleasing colour effects.

The repeated immersion in the sulphide solution, as well as the intermediate re-development, assists in making each sulphide tone darker than the preceding one. The result is a multi-tone print of which the untreated portions appear blue, the first toned portions pink, with various shades of red-brown to brown in between. The tendency towards blues and reds can be strengthened by further toning in the gold-thiocarbamide toner described below.

VARNISHING

After final washing and drying, the finished print can be improved by the application of the following print varnish :

<div align="center">

Poppy oil	...	1 part
Copal varnish	...	1 ,,
Turpentine	...	3 parts

</div>

This is applied with a piece of fine linen, such as a well-laundered handkerchief, and allowed to dry. Additional lustre is obtained by repeating the operation when the first application is dry.

Red, Blue and Green Toning. A variety of delightful red and blue tones are obtainable on almost any bromide or chlorobromide paper by using the following Kodak formula :

<div align="center">

ACID-GOLD-THIOCARBAMIDE TONING BATH

(*Blue to Red*)

Solution A

</div>

Gold chloride	...	...	15 grs.	or	1 gm.
Water	...	...	...	8 ozs.	,,	230 c.c.

Solution B

Thiocarbamide	...	...	50 grs.	or	3 gms.
Water	...	...	8 ozs.	,,	230 c.c.

Solution C

Sulphuric acid, conc.	...	$\frac{1}{4}$ oz.	or	6 c.c.
Water	...	...	20 ozs.	,,	500 ,,

WARNING. **Pour the sulphuric acid slowly into the water, not vice versa,** otherwise a violent reaction will occur.

For use—take 2 ozs. (60 c.c.) each of A and B, and add 2 ozs. (60 c.c.) of C, and make up to 10 ozs. with water (300 c.c.).

Black-and-white prints. Blue-black images tone a deep blue and warm-black images a light blue in about 5 minutes.

Sulphide or hypo-alum toned prints. Warm-sulphided prints tone bright red. Hypo-alum or cold-sulphided prints tone a deep rich red.

By using the partial re-development and sulphide process previously described, it is possible to arrive at any desired red or combination of red tones. These tones, and more particularly the reds, may be regarded as permanent.

Blue and Green Tones. Less permanent but pleasing blue and green tones are possible with the following formula :

SOLUTION A

Ferric ammonium citrate	...	15 grs.	or	1 gm.
Sulphuric acid, conc.	...	30 mins.	,,	2 c.c.
Water	...	...	20 ozs.	,,	600 ,,

SOLUTION B

Potassium ferricyanide	...	15 grs.	or	1 gm.
Sulphuric acid, conc.	...	30 mins.	,,	2 c.c.
Water	...	...	20 ozs.	,,	600 ,,

WARNING. **Pour the sulphuric acid slowly into the water, not vice versa,** otherwise a violent reaction will occur.

For use—take equal parts of each. Blot off washed prints, lay on flat surface and apply toner with swab of cotton-wool. This method keeps the back of the prints clean.

Black-and-white prints give blue tones, and sulphided prints green tones.

Highlights may be cleared by gently wiping parts with a dilute solution of sodium carbonate.

Prints thus toned gain in lustre and permanency by being finally treated with a good print varnish.

CHAPTER XVII
Dye Toning

IT might seem easy enough at first glance to dye a print any colour by just soaking it for a while in some dye ; but, in fact, that treatment would stain the whole print evenly—the whites would take up just as much colour (probably more) than the darker parts. To dye only the image on a print one must first convert that silver image into a compound which has a special affinity for the dye, thus absorbing and " fixing " it—the compound must hold it secure against the water used to wash away the colouring matter which also will have impregnated the gelatine and the paper.

CONVERTING THE SILVER IMAGE

In dye toning, the metallic silver of the image must be first converted into a mordant, such as silver iodide or silver ferrocyanide, which has the power to fix many of the basic dyes. This is known as mordanting and for this purpose the following formula, Kodak T-17, is recommended :

<div align="center">

MORDANTING BATH

(*Kodak T-17*)

</div>

Uranium (uranyl) nitrate	...	280 grs.	or	8 gms
Oxalic acid ...	...	...	140	,,	,,	4	,,
Potassium ferricyanide	...	140	,,	,,	4	,,
Water to make	...	...	80 ozs.	,,	1000 c.c.

The uranyl nitrate should be of good quality and should not contain an excess of free nitric acid. First dissolve each chemical separately in a small volume of water. Then add the oxalic acid solution to the uranyl nitrate solution and finally add the ferricyanide solution. After mixing, the bath should be light yellow and perfectly clear. The solution should not be exposed to light any more than is necessary.

For use, take 1 part of stock solution and 4 parts water.

Immerse the print at 65°-70° F. until a very slight chocolate-coloured tone is obtained and remove at once. If mordanting is prolonged much beyond this point, inferior tones will be produced. With a new bath this will require from 1½ to 2 minutes, but the time will need to be increased as the bath ages. The solution may be revived at intervals by adding a little of the concentrated stock solution.

After mordanting, wash until the highlights are free from yellow stain. This usually takes about 10 to 15 minutes. Do not prolong the washing for more than 20 minutes or some of the mordant will be washed out.

DYEING

After mordanting the print is then dyed by immersing the mordanted and washed print in the following dye bath (Kodak T-17a) for 2 to 15 minutes, according to the colour desired. The quantity of dye which mordants to the image increases with time. In case an image is over-dyed, some of the dye may be removed by immersing in a 0·2 per cent. solution of ammonia : then rinse before drying.

If, after dyeing for 10 minutes, the image does not mordant sufficient dye, remove the print, wash thoroughly, immerse again in the mordanting bath, wash and re-dye.

DYE BATH
(*Kodak T-17a*)

Dye ...	...	...	...	7 grs.	or	0·2	gm.
*Acetic acid, 10%	...	...	3 drs.	„	5	c.c.
Water to make	...	...	80 ozs.	„	1000	„

* To convert glacial acetic acid into 10 per cent. acid, take 1 part glacial acetic acid and add it slowly to 9 parts of water.

Thoroughly dissolve the dye in hot water, filter, add the acid, and dilute to volume with cold water.

The following dyes are suitable for toning :

Safranine A	... ...	Red
Chrysoidine 3R	... ...	Orange
Auramine	... ...	Yellow
Victoria Green	... ...	Green
Methylene Blue BB	...	Blue
*Methyl Violet	... ...	Violet

TONING WITH A DYE-COUPLED DEVELOPER

In the procedure just described, the silver is converted into a compound that has an affinity for certain dyes which it will hold or " fix," whilst the dyes are easily washed out of the surrounding gelatine and the supporting paper.

Another process can be adopted in which the dyes are not added but " manufactured " in the emulsion itself during the process of development. When a silver image is being developed, two things are happening : the silver is being reduced to a metallic state and the developer is being oxidised. Now it has been found that with certain developers the by-product of this chemical reaction is a substance, which, when combined with certain organic compounds, will form dyes of many different colours. When, therefore, such a compound is present in the developer, the oxidising developer will combine with it to make an insoluble dye image ; if the metallic silver image is subsequently dissolved away, then the one left will be just dye and nothing else.

Photographers who have used a pyro developer will be familiar with a somewhat similar phenomenon. Pyro gives a brownish image when development is forced, and if the silver of this is completely dissolved with Farmer's reducer, a faint yellow " stain " image is left—the oxidation

* For methyl violet use one-quarter the quantity of dye given in the formula.

product had combined with some unknown compound to produce this insoluble dye, or " stain." This may not be an exact analogy, but it will serve to illustrate what happens in the case of a dye-coupled developer.

There are a number of these organic substances which will produce dyes in a variety of colours and when used in this way they are known as " couplers " or, more correctly, as " formers." A dye-coupled developer will therefore produce a coloured image and the colour will depend on the coupler that has been incorporated with it. But these couplers will not work with all developers. Here the function of the developer is not so much the reduction of the silver as the formation of oxidation products—dye-forming intermediates as they are called—which will combine with the added organic compounds to form the final dye image.

Several such developers are available and formulæ for most of these have been published in the *British Journal of Photography*. The following is one of the more conventional :

Diethyl-p-phenylenediamine monohydrochloride	1 gm.
Sodium sulphite (cryst.)	10 gms.
Potassium carbonate (anhydrous)	20 „
Water to	1000 c.c.

To 100 c.cs. of this developer add (immediately before use) 10 c.cs. of one or other of the following :

<div align="center">COLOUR FORMERS</div>

Magenta

p-Nitrobenzylcyanide	...	...	...	0·8	gm.
Methylated spirit ...	...	...	...	100	c.c.

Brownish Yellow

Cyanacetanilide	...	...	...	...	0·4	gm.
Methylated spirit ...	...	...	...	50	c.c.
Acetone ...	...	...	...	...	50	„

Blue

α-Napthol ...	...	...	...	...	0·7	gm.
Methylated spirit ...	...	...	...	100	c.c.

Blue Green

| Dichloro-α-napthol ... | ... | ... | ... | I | gm. |
| Methylated spirit ... | ... | ... | ... | 100 | c.c. |

Pale Green

| Dichloro-o-cresol ... | ... | ... | ... | 0·9 | gm. |
| Methylated spirit ... | ... | ... | ... | 100 | c.c. |

Yellow

| o-Chloroacetoacetanilide ... | ... | ... | 1·05 | gms. |
| Methylated spirit ... | ... | ... | ... | 100 | c.c. |

By mixing the various formers many other colours can be obtained. For instance, 5 c.cs. each of the magenta and yellow added to the developer, will give a sepia, or equal quantities of the blue and yellow will make a green image ; in fact, almost any colour from a pale pink to an engraving black can be produced.

Whilst this method of producing a coloured print on bromide paper by a straightforward exposure and development is theoretically sound, there is a snag in it, as the diamine developers which one must use have a tendency to produce fog when dealing with a latent image. It is safer, therefore, to start with a normally developed black-and-white print, bleach this in any of the ferricyanide-bromide bleachers given for sulphide toning, and re-develop with the special developer to which colour formers have been added. This procedure gives more control over the colour and the strength of the image, and to a great extent obviates the fog. If the first colour produced is not pleasing, the print can be bleached again and re-developed, this time with another former or any admixture of these which the subject seems to call for.

It should be remembered that whichever of these methods is adopted, there is still present in the image the original black silver as well as the dye substance. This black degrades the colour somewhat, but if a pure colour is wanted, the

silver image can be entirely removed with Farmer's reducer, leaving only the dye.

There are many other variations of the process which will suggest themselves to the experimenter who cares to practise on some old prints—they may be either bromide or chlorobromide ; the latter, in fact, give even better results. Progress in the development of this process, outside the sphere of colour photography where it was cradled, will afford photographers new opportunities of making their prints more interesting.

COLOURFORM DEVELOPMENT

Whilst the foregoing may whet interest in the possibilities of colour development, the difficulty of procuring some of the necessary chemicals and the need for careful compounding will make those who are anxious to try it, welcome a process recently marketed by Johnsons of Hendon under the name " COLOURFORM." This has been evolved after a long period of research into the chemistry of colour-couplers and has resulted in an extremely simple process by which one may produce prints in a wide range of colours with no more skill than is required in making a straightforward black-and-white bromide.

This new product is marketed as a kit which contains, amongst other things, four bottles. One of these holds, in a very concentrated solution, the special basic developer which, if used alone, would give a black-and-white print. The other three bottles contain the colour " couplers " or " formers," each representing a primary colour and the addition of a small quantity of either of these to the diluted developer will produce a print in the colour it provides for. But prints in either of the three primaries are seldom, if ever, required, so the couplers are treated in much the same way as a painter would handle these prime colours on his palette ; by mixing them in varying proportions he can produce tints approximating most of those in the spectrum band.

The couplers, or "Colourforms," may be mixed in any proportion. Any one of them may be used or mixtures of two, or all three, may be added to the developer. In all cases the total volume of Colourform used must be 18 c.cs. to each 300 c.cs. of the developer, and it is important that this relation of 6 c.cs. to each 100 c.cs. of developer is maintained.

It is, of course, impossible to say exactly what proportion of the former will produce any particular shade, but as a guide a few suggestions are given in the following table :

				C.cs. Colourform to each 300 c.cs. (10 ozs.) Developer		
Colour required				Red	Blue	Yellow
Bright Blue	...	...	...	3	15	—
Grey Blue	...	...	...	4	12	2
Warm Brown	...	...	...	12	—	6
Cold Brown or Sepia	...	...	11	2	5
Bright Green	...	...	...	—	9	9
Sea Green	...	...	...	4	7	7
Magenta ...	...	...	...	18	—	—
Purple Brown or P.O.P. Tone ...			12	3	3

With a small quantity of developer a small test print or portion of a print can, after bleaching, be redeveloped to find if the tone is what is required before a larger volume of the mixture is prepared. Such prints should be kept and details of the formulæ used noted for future reference.

PRINTS IN SEVERAL COLOURS

Interesting effects can be produced by developing different areas of the same print in different mixtures of developer and Colourforms. Complicated colour-schemes can be undertaken by the use of waterproof varnishes and resists, but striking effects can be produced without these.

Suppose it is required to colour one area of a print green and another area brown. Using a pad of cotton wool or a small brush dipped in the bleach solution (or a mixture of equal parts 5 per cent. potassium ferricyanide and 5 per cent. potassium bromide solutions) carefully work over the area

to be coloured green until the black silver image is completely bleached. Then wash the print for 5 minutes and immerse it in Colourform developer to which has been added the correct quantities of the Colourforms to produce a green tone. The bleached area will develop up green leaving the rest of the print unaffected.

Wash the print for 5 minutes and then repeat the above procedure, this time bleaching the area to be toned brown and using developer to which a brown mixture of Colourforms has been added.

This can be repeated with any number of different areas. After treatment is complete, wash for 10 to 15 minutes and dry.

REMOVAL OR REDUCTION OF THE DYE IMAGE

A print or slide may be returned to its original (untoned) state by soaking it for a few minutes in dilute hydrochloric or acetic acid (1 part of concentrated acid to 15 parts water). The dye image may be removed locally by applying this solution by means of a small brush or pad of cotton-wool.

The intensity of the dye image may be gradually reduced by soaking the print or slide in a very dilute acid solution (e.g., 1 part concentrated hydrochloric acid to 500 parts water). When the desired effect is obtained, immerse the print in an alkaline stop bath of 2 per cent. sodium carbonate solution and wash for 5 minutes.

A good deal of space has been given to the subject of colour-development because it is increasingly evident that pictorialists are becoming more and more conscious of the greater power of expression which the judicious use of colour can add to a print, and, it is believed, it is by this recently introduced technique that the " new look " will be achieved.

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CHAPTER XVIII
Toning Formulæ

THERE are innumerable variations of the formulæ given in the preceding pages for chemical toning. Many of them have been arrived at empirically and others made up to suit a particular technique. In the following pages we give a series which have been worked out and tested in the laboratories of Kodak Ltd.

NELSON GOLD TONING BATH
(*Kodak Formula T-21*)

Stock Solution 1

Warm water (about 125° F.)	80 ozs.		or	1000	c.c.	
Hypo	19	„		„	240	gms.
Ammonium persulphate ...	2 „ 175 grs.			„	30	„

Dissolve the hypo completely and then add the persulphate with vigorous stirring. If the bath does not turn milky, increase the temperature until it does.

Prepare the following solution and add it (including precipitate) slowly to the hypo-persulphate solution while stirring the latter rapidly. *The bath must be cool when these solutions are added together.*

Cold water	5 ozs.	or 64	c.c.
Silver nitrate (cryst.) ...	180 grs.	,, 5·2	gms.
Sodium chloride	180 ,,	,, 5·2	,,

Note.—The silver nitrate should be dissolved before adding the sodium chloride.

Stock Solution 2

| Water ... ... | 80 ozs. | or 1000 | c.c. |
| Gold chloride ... ... | 140 grs. | ,, | 4 gms. |

For use, add 4 ozs. (125 c.c.) of Solution 2 slowly to Solution 1 while stirring the latter rapidly.

The bath should not be used until after it has become cold and has formed a sediment. Then pour off the clear liquid for use.

HYPO-ALUM TONING BATH
(*Kodak Formula T.*51)

To prepare the hypo-alum toning bath, dissolve 1 lb. (200 grams) of hypo in 80 ozs. (1,000 c.c.) of hot water, then add 3½ ozs. (44 grams) of ordinary potassium alum ; stir well and boil for two or three minutes ; cool down to about 150° F. (65° C.) and add the following silver ripener :

Dissolve 20 grains (0.5 grams) of silver nitrate in one ounce (15 c.c.) of water and add drop by drop (.880) ammonia with vigorous stirring until the precipitate first formed is just redissolved, and stir the solution so formed into the hypo-alum mixture. In a further ounce of water dissolve 30 grains (1 gram) of potassium iodide ; add this also to the hypo-alum mixture and stir well.

The bath can be used repeatedly, but it must be kept to its original bulk by the occasional addition of fresh solution, being discarded when it ceases to tone satisfactorily.

Prints for toning by this method should be fixed as usual, briefly rinsed in water, soaked for ten minutes in a saturated solution of potassium alum, rinsed and toned at a temperature not exceeding 140° F. (60° C.). After toning, sponge the

prints with lukewarm water to remove the sediment and wash as usual.

SEPIA TONING BATH FOR CHLORO-BROMIDE PRINTS
(Kodak Formula T-52a)

A. Bleaching Solution

Potassium bromide...	...	1 oz. 85 grs. or	15 gms.
Potassium ferricyanide	...	1 „ 85 „ „	15 „
Ammonia ·880	... ...	2 ozs.	„ 20 c.c.
Water up to	... ...	80 „	„ 1000 „

B. Toning Solution

Sodium sulphide, 10% sol....	10 ozs.	or	120 c.c.
Potassium bromide...	...	132 grs.	„ 4 gms.
Water up to	... ...	80 ozs.	„ 1000 c.c.

Bleach in Solution A, wash until the yellow stain is removed, and tone in Solution B. Complete with a brief wash in running water. Throw away Solution B after use.

SEPIA TONING BROMIDE PRINTS SULPHIDE METHOD
(Kodak Formula T-52)

A. Bleaching Solution

Potassium ferricyanide	...	4 ozs.	or	50 gms.
Potassium bromide...	...	4 „	„	50 „
Water to make	... ...	80 „	„ 1000 c.c.

B. Stock Sulphide Solution

Sodium sulphide, pure	...	16 ozs.	or	200 gms.
Water to make	... ...	80 „	„ 1000 c.c.

C. Toning Solution

Stock solution B	... ...	4 ozs.	or	50 c.c.
Water to make	... ...	80 „	„ 1000 „

Bleach in Solution A, wash till yellow stain is removed, and tone in Solution C. Complete with brief washing in running water. Throw away Solution C after use.

DOUBLE TONING BATH
(*Kodak Formula T-*18)

Ammonium persulphate	...	18 grs.	or		0·5 gm.	
Iron ammonium sulphate						
(ferric alum) ...	...	50 ,,	,,		1·4 gms.	
Oxalic acid	...	110 ,,	,,	3·2	,,	
Potassium ferricyanide	...	35 ,,	,,	1	gm.	
Hydrochloric acid (10%						
solution) ...	...	40 mins.	,,	1	c.c.	
Water up to ...	...	80 ozs.	,,	1000	,,	

The method of compounding this bath is very important. Each of the solid chemicals should be dissolved separately in a small volume of water, the solutions then mixed strictly in the order given, and the whole diluted to the required volume.

Tone until the shadows are deep blue. Then wash for 10 to 15 minutes. Immerse in the basic dye solution used for dye toning (see page 107) for 5 to 15 minutes, until the desired depth of colour in the half-tones is obtained. Wash 5 to 10 minutes after dyeing until the highlights are clear.

SULPHIDE-SELENIUM TONER
(*Kodak Formula T-*56)

A. *Bleaching Solution*

Potassium ferricyanide	...	4 ozs.	or	50 gms.
Potassium bromide...	...	4 ,,	,,	50 ,,
Water up to ...	...	80 ,,	,,	1000 c.c.

B. *Stock Sulphide-Selenium Solution*

Sodium sulphide (pure)	...	20 ozs.	or	250 gms.
Selenium powder ...	...	200 grs.	,,	50 c.c.
Water up to ...	...	80 ozs.	,,	1000 ,,

C. *Toning Solution*

Stock solution B ...	...	4 ozs.	or	50 c.c.
Water up to ...	...	80 ,,	,,	1000 ,,

Bleach in Solution A, wash until the yellow stain is removed, and tone in Solution C. Complete with brief wash in running water. Throw away Solution C after use.

This formula is recommended for the toning of Velox, Bromesko, chloro-bromide papers and for Kodak bromide papers when colder tones than those obtainable in the sulphide toning formula T-52 are desired. The tones obtained with this formula are intermediate between those given by T-52 and T-55 (selenium toner).

<div align="center">

SELENIUM TONER

(Kodak Formula T-55)

Stock Solution

</div>

Sodium sulphite (cryst.) ...	24 ozs.	or	300	gms.
(Or anhydrous)	12 ,,	,,	150	,,
Selenium powder	210 grs.	,,	6	,,
Ammonium chloride ...	15 ozs.	,,	190	,,
Water up to	80 ,,	,,	1000	c.c.

Dissolve the sulphite in about 700 c.c. of hot water, then add the selenium powder ; boil until it is completely dissolved. Allow the solution to cool, then add the ammonium chloride and stir till this is dissolved. Finally make up to the required bulk with cold water.

For use dilute 1 part of stock solution with 5 parts of water.

Prints should be fixed and well washed before toning in the above solution for 10 to 15 minutes at 65° F. Finally wash well before drying.

SOME PROPRIETARY TONERS

Pactum toners by Johnson are sold in packets and only need the addition of water to make baths which will give sepia, blue, green or red tones with the minimum of trouble.

Tabloid toners, manufactured by Burroughs Wellcome, are packed in cartons and provide for Blue, Green, Sepia, and

Brown tones. This firm also markets a Copper-Ferricyanide Compound which gives the complete range of colour between warm-black and red-chalk. They also supply a series of " Soloid " Stains which can be used to obtain multi-colour effects when used in the toning and staining processes described earlier.

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35 mm

COLOR

MAGIC

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